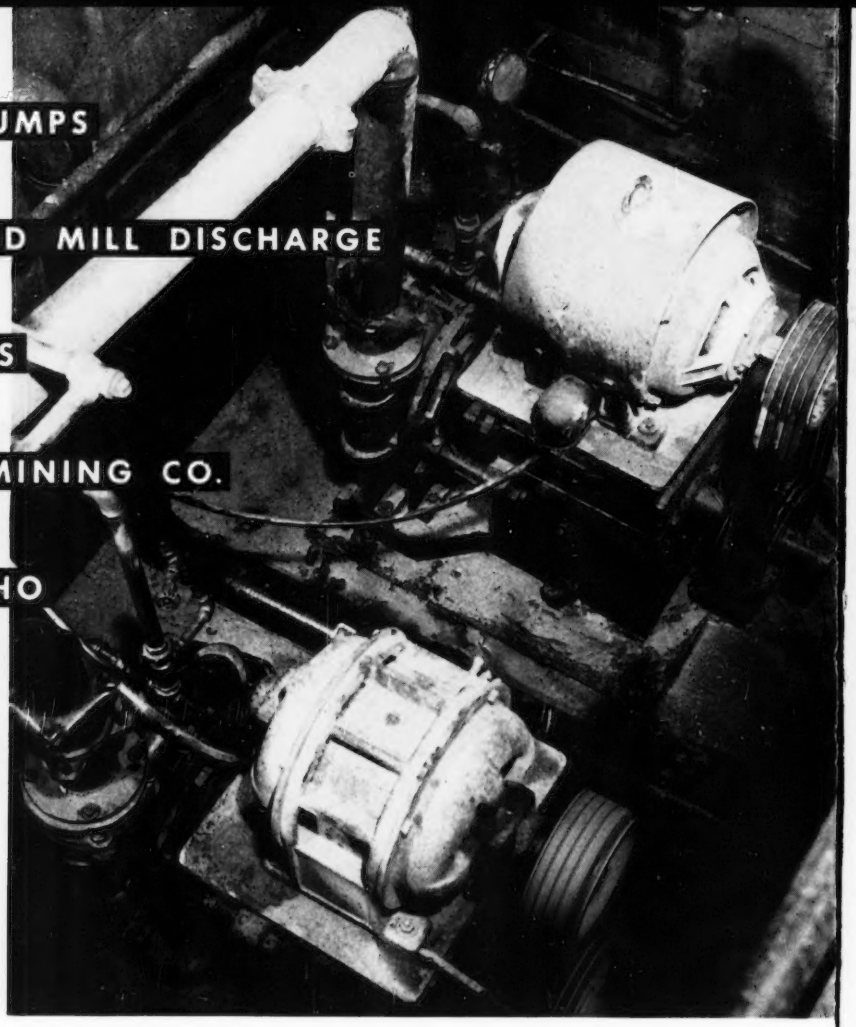
ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

NOVEMBER, 1949

The Real Dangers of High Costs— Page 72



HYDROSEAL PUMPS HANDLING ROD MILL DISCHARGE TO BALL MILLS AT BRADLEY MINING CO. STIBNITE, IDAHO

Yellow Pine Mine Gets Economies of

HYDROSEALS

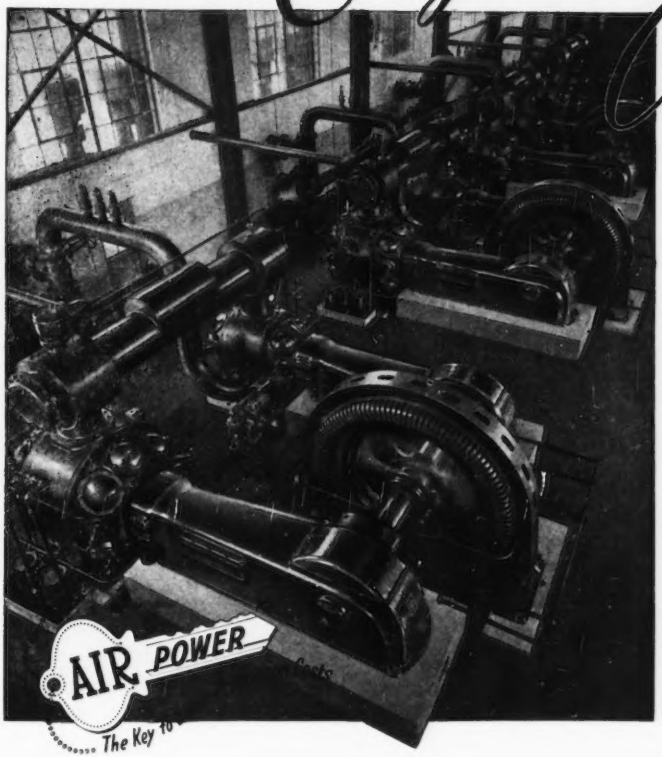
on Numerous Other Jobs, Too

Although the "Yellow Pine Mine" has been operated since 1927 producing gold and antimony, when high grade tungsten was discovered in 1941, its daily capacity was increased from 450 to approximately 800 tons. Since then, the tonnage has been increased to 2500 tons and many Hydroseal Pumps have been installed, both new and as replacements.... One of the jobs assigned to Hydroseals (admittedly a tough one) is the pumping of more than 100 tons per hour of rod mill discharge to the ball mills. They have been doing a "good job" ever since installed.... If you have a pumping job where maintenance or power costs are exorbitant, remember what you read here about Bradley Mining Co. Catalog on request. *The Allen-Sherman-Hoff Company, 229 S. 15th Street, Philadelphia 2, Pa., U. S. A. Representatives in Most Principal Cities.*

HYDROSEAL SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED

HYDROSEAL PACKLESS AND MAXIMIX DESIGNS ARE COVERED BY PATENTS AND APPLICATIONS IN THE MAJOR MINING CENTERS OF THE WORLD

BACK OF *Every* INGERSOLL-RAND *Compressor* ARE THESE *SupIRvalues*



This 2800-horsepower installation of Ingersoll-Rand *Class PRE Compressors* generates the Air Power for one of America's outstanding metal mines. It is typical of thousands of similar heavy-duty compressors that are so essential in practically every industry.

Whether they supply Air Power for Air Tools in factory, mine, or construction work, or compress hazardous gases at extremely high pressure in a costly process, the purchaser must rely upon the experience and judgment of the manufacturer for a dependable compressor that meets his specific requirements. To make sure you get the best, select an Ingersoll-Rand Compressor... backed by *SupIRvalues*

Tradition...a 77-year old company that grew from the *two of the earliest* compressor builders in America.

Experience and Know-how to build compressors for *any* pressure, *any* gas, *any* size, *any* service.

Facilities *second to none*... for design, research, metallurgy, and manufacture.

Range of sizes . . . with *standardized* frames, running gears and interchangeable cylinders ... plus *special* cylinders, valves and coolers for special applications.

Flexibility of Drive . . . a *choice* of compressors powered by electric motor, oil, gas, or steam.

Record of Performance ...thousands of compressors successfully operating in *every* branch of industry.

Design Features that give you the best in efficiency, durability, dependability, easy operation, and low maintenance.

Trained Personnel ...men who *know* Air Power...who build, sell, and service air drills and tools as well as compressors.

Progressive Policy...*continuous* pioneering and development of both new and old products.

Service ...with offices in principal cities *all over the world.*

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y. 267-1

COMPRESSORS · ROCK DRILLS · AIR TOOLS · BLOWERS · PUMPS · ENGINES · HOISTS · VACUUM EQUIPMENT

Move rock at bedrock cost with a B.F.Goodrich "beltroad"

ARE you moving stone or ore out of pit or quarry, removing overburden, feeding a crusher, moving sand, gravel, rock, dirt to stockpile or construction site? There is a B.F.Goodrich conveyor belt that will help you keep costs at bedrock — deliver more tons per belt-dollar, with less maintenance per ton.

On rock jobs with heavy impact loads, where the rock drops onto the belt from a height, where loads are often overloads, where centers are long and the lift high, B.F.Goodrich *cord* belts do an outstanding job. The reason: load is carried by parallel cords, each cord completely surrounded by rubber and independent of the others, free to "give" and spread when big rock strikes. This allows the rubber to distort temporarily and distribute shocks that would damage an unyielding belt carcass. It gives 2 to 6 times more impact resistance.

For jobs that don't require cord construction — moving sand, gravel, dirt, small rock — use B.F.Goodrich fabric belts. They have exclusive square-edge construction. Each layer of top or bottom ply fabric runs only from belt edge to edge — no folding or doubling to make it serve as part of the next fabric layer. This eliminates seams in the belt that sometimes prevent proper troughing, that set up uneven strains. It helps keep the belt aligned properly, reducing edge wear and maintenance.

Whatever you move by conveyor belt — rock, ore, sand, gravel, dirt, coal, all types of material — a B.F.Goodrich "beltroad" will keep costs at rock-bottom, tonnage peak-high. Ask your local BFG distributor how to get more tons for the money from your conveyor belting. Or write: *The B.F.Goodrich Company, Industrial and General Products Division, Akron, Ohio.*

Conveyor Belts BY
B.F.Goodrich

ENGINEERING AND MINING JOURNAL

FOUNDED 1866

VOLUME 150 — NOVEMBER, 1949 — NUMBER 11

E & M J Outlook 67

Market Summary 68

Behind the By-Lines 70

Editorial 71

The Real Danger of High Costs . . . . . PLATO MALOZEMOFF 72

A Non-Metallic Producer Reduces Costs . . . . . W. H. GABELER 79

How U. S. Smelting Attacks Problem of Cost Reduction 80

Hollinger's Wage Incentive System Gets Results . . . . . J. W. THOMSON 82

A Safety Program Can Also Curb Costs . . . . . W. E. JONES 86

Changing Practice Favors Reduction of Breaking Cost . . . . A. H. HUBBELL 88

Cost Cutting at Star Mine Helped by Many Factors . . . . . R. W. NEYMAN 90

Unique Equipment Helps in Cutting Shale Mining Costs . . . E. D. GARDNER 92

Gold Producer Starts Right With Low Costs 95

Cleveland-Cliffs Combats Rising Costs . . . . . A. H. HUBBELL 96

Meeting Higher Underground Costs on the Mesabi . . . . . E. P. PFLEIDER 100

Ten Ways to Cut Your Grinding Costs 106

Washington Reflections 108

News of the Industry 110

Operating Ideas 114

Personal News 116

Equipment News 122

Regional News 127

ALFRED M. STAEHLE, Publisher **EVAN JUST, Editor, on leave** **R. W. DAVIS, Sales Manager**

R. H. RAMSEY, Acting Editor; H. C. PARMELEE, Editor Emeritus; A. H. HUBBELL, Managing Editor; A. W. KNOERR, Associate Editor; H. H. WANDERS, Market Editor; G. P. LUTJEN, F. W. BROOKE, Assistant Editors; F. A. ZIMMERLI, Layout Editor. San Francisco: J. B. HUTTL, Associate Editor; G. J. YOUNG, Consultant. Washington: PAUL LEACH, Jr.

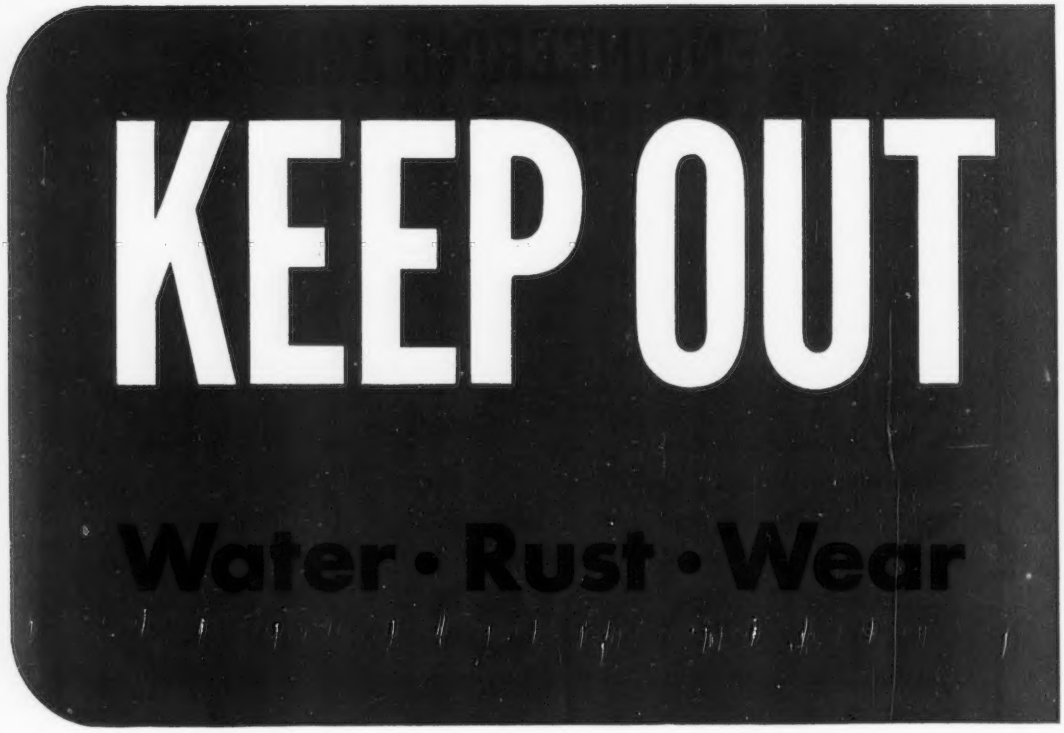
McGraw-Hill Publishing Company, Inc.—James H. McGraw (1860-1948), Founder. James H. McGraw, Jr., President; Curtis W. McGraw, Vice President and Treasurer; Eugene Duffield, Senior Vice President. Publications Division: Nelson Bond, Vice President and Director of Advertising; Joseph A. Gerardi, Secretary; Dexter Keezer, Director, Economics Department; J. E. Blackburn, Jr., Vice President and Director of Circulation.

Company Offices: Publication office: 210 S. Desplaines St., Chicago 6, Ill. Editorial and Executive Offices: 330 West 42nd St., New York 18, N. Y. Cable address: McGraw-Hill, New York. Branch Offices: San Francisco 4, 68 Post St.; Chicago 11, 520 N. Michigan Ave.; Los Angeles 14, Pacific Finance Bldg.; Washington, D. C., National Press Bldg.; Pittsburgh 22, 738-9 Oliver Bldg.; Detroit 26, 2980 Penobscot Bldg.; Cleveland 15, 1510 Hanna Bldg.; Boston 16, 1427 Statler Bldg.; Philadelphia 3, 17th & Sansom Sts.; Atlanta 3, 1011 Rhodes-Haverty Bldg.; St. Louis 8, Continental Bldg. District Managers: New York, T. E. Alcorn, F. W. Roets; Philadelphia, W. A. Potter; Cleveland, W. M. Spears; Pittsburgh, H. C. Chellson; Chicago, C. J. Coash and G. A. Mack; San Francisco, J. W. Otterson; Atlanta, R. C. Maultsby; Los Angeles, C. W. Dysinger. London address: McGraw-Hill Publishing Co., Ltd., Aldwych House, Aldwych London, W.C. 2, England. Cable address: McGraw Hill, London. Other McGraw-Hill foreign news offices in Paris, Berlin, Moscow, Prague, Shanghai, Bombay and Mexico City.

A McGRAW-HILL PUBLICATION

Subscription Information: ENGINEERING AND MINING JOURNAL, November, 1949. Vol. 150, No. 11. Published monthly at Chicago, Ill. Return postage guaranteed. Subscription rates: United States and possessions $3 a year, $4 for 2 years, $5 for 3 years. Canada $4 a year, $6 for 2 years, $8 for 3 years. Pan American countries $5 a year, $8 for 2 years, $10 for 3 years. Elsewhere $15 a year, $25 for 2 years, $30 for 3 years. Please indicate position and company connection in all subscription orders. Price of this issue, 50 cents. Entered as second class matter August 16, 1948, at the post office at Chicago, Ill., under the Act of March 3, 1879.

Copyright 1949, McGraw-Hill Publishing Co., Inc. All rights reserved.



Assure better compressor performance . . . with the TEXACO air compressor oils made to

No guesswork when you lubricate with Texaco air compressor oils. There is a complete line of them so that, *regardless of your operating conditions,* you can be sure of clean valves, free rings, open ports and clear air lines. Here's the set-up —

For regular service, Texaco straight mineral oils.

For water conditions, Texaco compounded oils.

For rust prevention, Texaco rust-inhibited oils.

For severe service and elimination of carbon and gum troubles, Texaco heavy-duty oils.

TEXACO

TEXACO

Photo courtesy Joy Mfg. Co., Sullivan Division

meet *your* operating conditions

All are designed to give you greater operating efficiency . . . prolong compressor life . . . reduce your maintenance costs.

Best evidence of mine operators' preference for Texaco is the fact that: *More copper mining equipment in the U. S. is lubricated with Texaco than with any other brand!*

To be sure of getting the right lubricants for your compressors, let a Texaco Lubrication Engineer help you select them. Just call the nearest of the more than 2300 Texaco Wholesale Distributing Plants in the 48 States, or write to The Texas Company, 135 East 42nd St., New York 17, N. Y.

LONGER LIFE FOR OPEN GEARS

Lubricate open gears with Texaco Crater X Fluid. It goes on as a liquid, then quickly forms a tough, long-lasting film that absorbs noise, shock and wear. Gears last much longer with this economical protection, easily applied by brushing, spraying or pouring.

Lubricants and Fuels

FOR THE MINING INDUSTRY

FOR RUGGED DIGGING STRENGTH

FOR BIG YARDAGE OUTPUT...

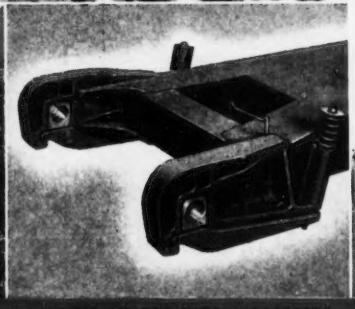
Steady production day in, day out, on your toughest excavating work, you can't afford to overlook the many cost-cutting advantages of this rugged, heavy-duty Koehring 605 shovel.

Heavy-duty rock boom of rigid box design is extra deep below shipper shaft, withstands the digging twists and strains of heaviest shovel work. Shipper shaft mounted on top gives still greater strength in the deep mid-section. Heavy steel rubbing plates protect boom against wear from dipper sticks. Boom foot is massive, wide . . . provides a solid base for heavy-duty digging.

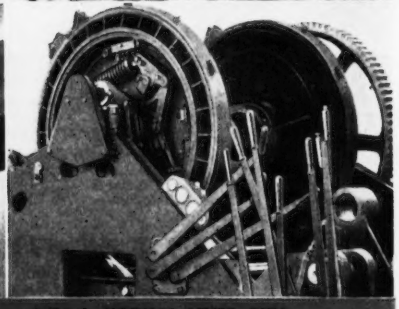
Shock-absorbing boom mount . . . fast operating speeds . . . big 1½ yard dipper . . . power-operated clutches, all help keep production high, costs low. Check, too, how this 605's compact, accessible machinery arrangement simplifies adjustments, lowers maintenance costs, and increases work-time. For complete facts, see your Koehring distributor today. Other Koehring heavy-duty sizes: ¾-yard 304, and ½-yard 205.

KOEHRING HEAVY DUTY

HEAVY-DUTY DIPPER is built for long-lasting service in the toughest digging . . . has manganese lip, reversible teeth, big pins, manganese bushings . . . is all welded for extra strength, less deadweight and bigger payload.



"BOOM-GUARD" SHOCK ABSORBERS Heavy coil springs, one on each side of boom foot, cushion jars of fast rock handling . . . protect entire shovel attachment, without sacrificing rigidity. Easier on the machine, easier on the operator.



1/10th NORMAL LEVER PULL . . . Koehring power clutch does the heavy work . . . supplies 90% of the effort when operator sets this big 37" clutch. Average 7 lb. lever pull reduces operator fatigue, yet retains "feel" of load.

. . . USE KOEHRING HEAVY-DUTY

1½ YD. 605

FAST-SHUTTLING DUMPTORS CAN STEP UP OUTPUT ON YOUR OFF-HIGHWAY HAULS

KOEHRING COMPANY
Milwaukee 10, Wisconsin

Subsidiaries: JOHNSON • PARSONS • KWIK-MIX

KEY MACHINE around a mine

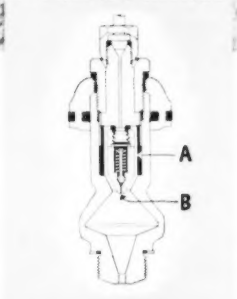
Matched "Caterpillar" equipment keeps rock rolling right along! Price of a standard "Caterpillar" D8 Tractor is $12,805; No. 8A Bulldozer, $2370; No. 25 Cable Control, $1420. (F.O.B. Peoria, prices subject to change without notice.)

STRIPPING overburden and building churn drill access roads are only a few of many jobs handled in stride by this "Caterpillar" Diesel D8 Tractor and matching "Caterpillar" No. 8A Bulldozer. Here you see this versatile team of the Isbell Construction Co. bearing down on an Arizona copper mine project.

Rock work gives equipment a beating, but these precision-engineered "Caterpillar" matched units are built to stand the gaff. Take the 'dozer blade, for instance. Special high-tensile steels make the moldboard as rugged as they come, and the full box section backing provides a blade that can dish it out and take it.

Manufactured by one company, the "Caterpillar" D8 Tractor and No. 8A 'Dozer make a finely balanced unit that can really go to town at low cost for you. Service, too, is centered in one live-wire dealer, so the advantage is yours all ways when you use matched "Caterpillar" equipment!

CATERPILLAR TRACTOR CO. • PEORIA, ILLINOIS



HI-EFFICIENCY FUEL INJECTION VALVE

Typical of the quality built into "Caterpillar" Diesel Tractors are the fuel injection valves. Capsule (A) is easily removable for unit replacement in the field. No adjustments are necessary. Large single orifice opening at (B) prevents clogging and maintains desirable fuel spray characteristics at all times. Countless "Caterpillar" Engines have operated many thousands of hours without the need for capsule replacements.

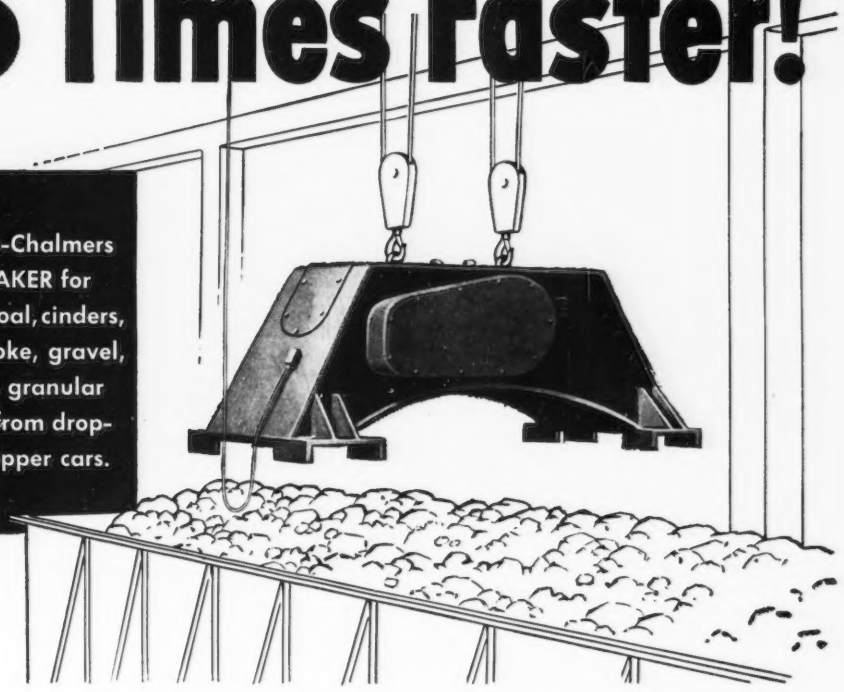
CATERPILLAR DIESEL

REG. U. S. PAT. OFF.

ENGINES • TRACTORS • MOTOR GRADERS • EARTHMOVING EQUIPMENT

Unload Materials 15 Times Faster!

New! Allis-Chalmers CAR SHAKER for unloading coal, cinders, ore, slag, coke, gravel, and other granular materials from drop-bottom hopper cars.



DO A 30 MINUTE JOB IN 2 MINUTES! Yes, a hopper car which required up to 30 minutes to unload manually can now be unloaded in as little as two minutes with the new Allis-Chalmers Car Shaker!

And you save on safety! Accidents are eliminated as workmen do not have to mount the car during the automatic unloading operation. Vibratory motion of the Shaker is transmitted to the car and loosens bridged granular material so it flows freely through the hopper openings.

The Shaker is driven by a 15 hp, high torque, integrally enclosed Allis-Chalmers motor — mounted on rubber to protect motor from severe vibration.

For complete information on how this new Car Shaker can help *you* save time and money, contact your nearby A-C Sales Office. Or send in the handy coupon below.

CHECK THESE SEVEN MONEY AND LABOR SAVING FEATURES!

1. Motor is located inside body; drive completely covered by guard.
2. Size of body and shoes designed to fit all hopper cars operating on the North American continent.
3. Simplified mechanism reduces number of working parts.
4. Hydraulic arrangement for bearing removal.
5. Car Shaker heavily designed—Stress relieved after welding and before machining.
6. Shaker is well balanced for ease in handling by crane or hoist.
7. Designed for use with noise dampening pads where required, or with removable wearing shoes.

A-2857

ALLIS-CHALMERS, 969A SO. 70 ST. MILWAUKEE, WIS.

Please send Car Shaker Bulletin 0787221.

Name_____

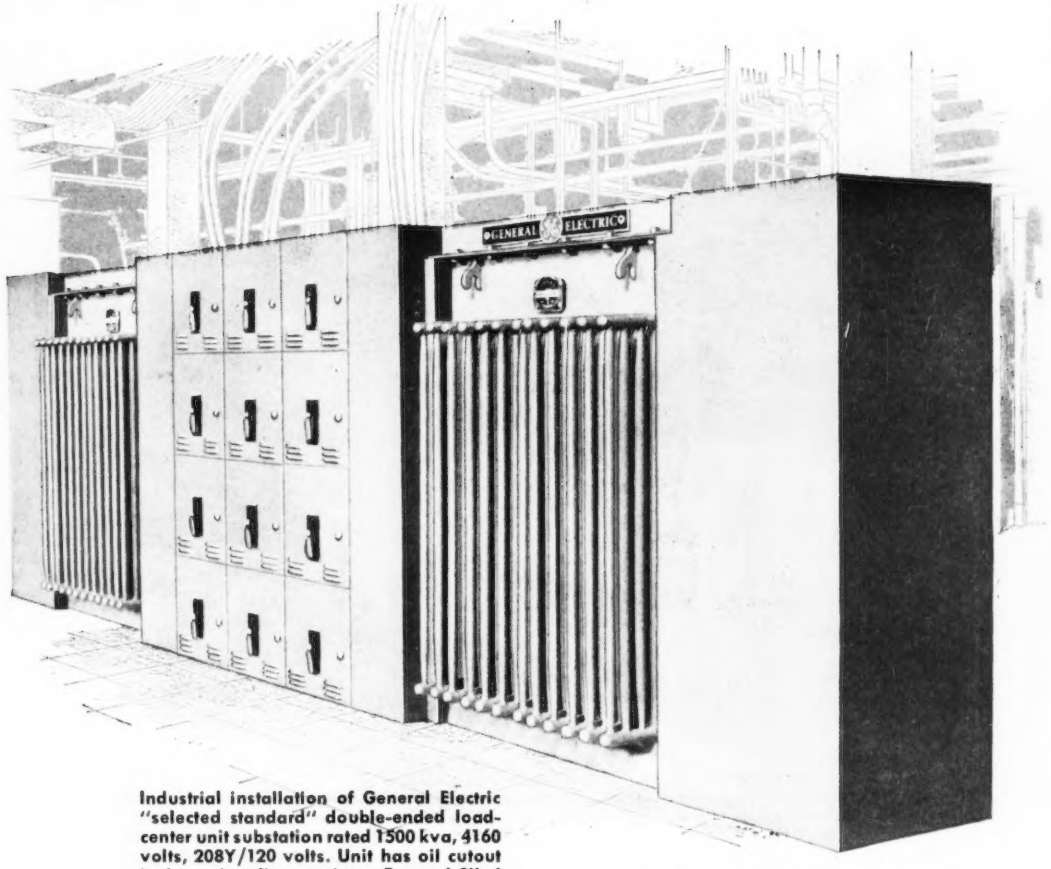
Title_____

Firm_____

Address_____

ALLIS-CHALMERS

new load center unit



Industrial installation of General Electric "selected standard" double-ended load-center unit substation rated 1500 kva, 4160 volts, 208Y/120 volts. Unit has oil cutout in incoming line sections, Pyranol-filled transformers, and the new AK-1 air circuit breakers.

★ *Be sure to see the "More Power to America" full-color sound slidefilm "Modern Industrial Power Distribution." Ask your G-E sales representative to arrange a showing for your organization.*

substations

• improved appearance

Note the smooth, integrated appearance of these new G-E Pyranol® unit substations . . . no more gawky, "old-type" bus-duct connections between transformer and switchgear . . . now you can get the effortless flow of line and power that characterizes quality equipment for locations where appearance is a requisite.

• 'selected standards'

Based on surveyed demands of industry and proposed NEMA specifications, "selected standard" ratings have been inaugurated to bring you these efficient new load centers on shorter shipment. The most popular "selected standard" ratings are:

Low voltage—480△, 208Y/120 volts
High voltage—2.4, 4.16, 4.8, 12, 13.2, 13.8 kv
Kva ratings—300, 500, 750, 1000, 1500, 2000

Certain other "selected standard" load centers are available. Contact your G-E sales representative for further information.

• shorter shipments

By ordering "selected standards," you get really short shipments on Pyranol and dry-type load centers. Deliveries are in line with average plant construction schedules and it is suggested that load centers be ordered when construction begins.

• high impulse levels

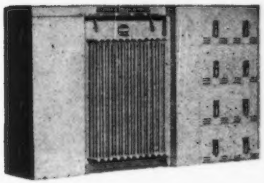
Pyranol unit substations with their inherently high impulse levels are particularly suitable for locations that are subject to switching surges and lightning.

Remember too, that G-E load-center power distribution is the most economical power distribution you can buy . . . no heavy, costly long-run feeders, no "piecemeal" purchases, no divided responsibility.

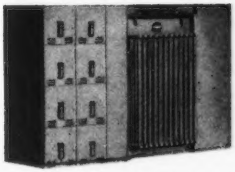
You'll save time too, because G-E "selected standard" load centers eliminate weeks spent over drawing boards detailing individual items; you'll save time because G-E factory-assembled unit substations are quickly and easily installed—in the center of the load area—with lower material and labor costs than required for "piecemeal" assemblies.

Ask your G-E sales representative *today* about how "selected standard" load centers can save time and money in your plant. Also, write for Bulletin GEA-3592.

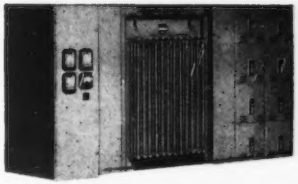
◀ *Apparatus Department, General Electric Company, Schenectady 5, New York.*



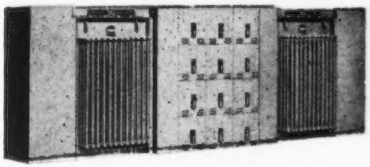
Typical 500 kva G-E "selected standard" load-center unit substation (standard arrangement). Unit consists of primary interrupter switch, liquid-filled transforming section, and low-voltage feeder switching section with the new Type AK-1 drawout breakers.



Same as unit shown above but with reversed arrangement.



Typical 500 kva G-E "selected standard" load-center unit substation with liquid-filled transforming section, metal-clad air power circuit breaker for incoming line-protection, and low-voltage feeder switching section with the new Type AK-1 drawout breakers.



G-E "selected standard" double-ended load-center unit substation rated 1500 kva with primary interrupter switches, liquid-filled transforming sections, and low-voltage feeder switching section with G-E Type AK-1 drawout air circuit breakers arranged for secondary selective service.

GENERAL ELECTRIC

"When YOU do the blasting— you appreciate Du Pont 'MS' Caps"

"You see more and more mine operators turning to Du Pont 'MS' (Millisecond) Delay Electric Blasting Caps. The way they look at it . . . these caps lower the cost of explosives per ton of ore mined . . . in both outside and underground work.

"And when you do the blasting yourself, you appreciate working with 'MS' Caps. For one thing, you feel safer. These caps pull the rounds clean . . . leave no dynamite in the muck, and the chances are that you can reduce your explosive load appreciably. What's more, blasting with 'MS' Delays greatly cuts down concussion and vibration. They are easier to work with, too. Priming is simplified because 'MS' Caps are all the same length. And there's no mistaking the clearly marked delay periods on each cap . . . even if there is poor light at the working face.

"One thing more. When you're using Du Pont 'MS' Delay Electric Blasting Caps, you know there's going to be a lot less secondary blasting. We've seen these caps give well-broken ore time after time . . . even from badly fractured veins.

"We work with them . . . we know."

Ask any Du Pont Explosives representative for complete information about "MS" (Millisecond) Delay Electric Blasting Caps. He'll be glad to help you with any blasting problem you may have. E. I. du Pont de Nemours & Co. (Inc.), Explosives Dept., Wilmington 98, Del.

DU PONT EXPLOSIVES

BLASTING SUPPLIES AND ACCESSORIES

Du Pont "MS" Delay Electric Blasting Caps

HAVE THESE IMPORTANT SAFETY FEATURES:

1. Nylon insulated wires. Brightly colored for easy identification in hooking up. Clean to handle.

2. Rubber plug closures are double-crimped into shells, highly water-resistant.

3. Aluminum foil shielded shunts. Bared ends short-circuited for entire length and shielded from accidental contact with electric currents.

"MS" Caps are supplied in 14 clearly marked delay periods ranging from 25 to 500 milliseconds.

JUST OUT!

New Edition Blasters' Handbook

470 pages of up-to-the-minute information every blaster can use. Outlines accepted methods, contains new charts . . . new tables . . . and an officially approved check list of safety measures. Shows best ways of preparing, priming, loading and blasting charges in all kinds of work. Send for your copy now . . . $1.50 postpaid.

Listen to "Cavalcade of America" —Tuesday Evenings—NBC

DUPONT

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

GOLD!

● Maybe that rig you have feeding the doodlebug is beginning to *give up the ghost*. Look ahead and plan for those future diggings. You can't afford anything but the best for the heart of your job—a doodlebug sitting still isn't good for much.

Plan ahead now to have a Northwest when the present machine gets to the expensive stage. Plan to have the easy maintenance that Northwests bring you, the "Feather-Touch" Clutch Control (there won't be any shutdown because of control failure or delay on frosty mornings). Plan to have the stamina that Northwest Cast Steel Bases and Cast Steel Machinery Side Frames give you (these mean the maintenance of alignment for bearings and shafts and reduced wear). Plan to have Northwest Uniform Pressure Swing Clutches and other Northwest advantages that mean output at lower cost. Northwest features will step up doodlebug output too.

This is a *Key Spot*—worth planning ahead for. Let us tell you how. Ask for complete details.

NORTHWEST ENGINEERING COMPANY
1509 Field Building
135 South LaSalle Street
Chicago 3, Illinois

MAKE YOUR KEY MACHINE A NORTHWEST CRAWLER CRANE For the heart of the job!

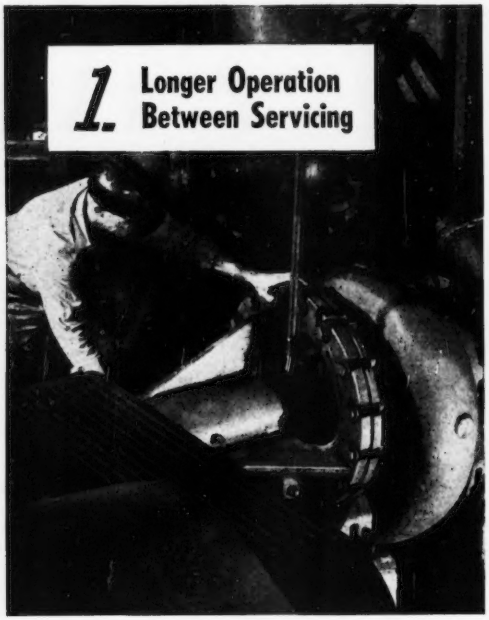
PROFIT

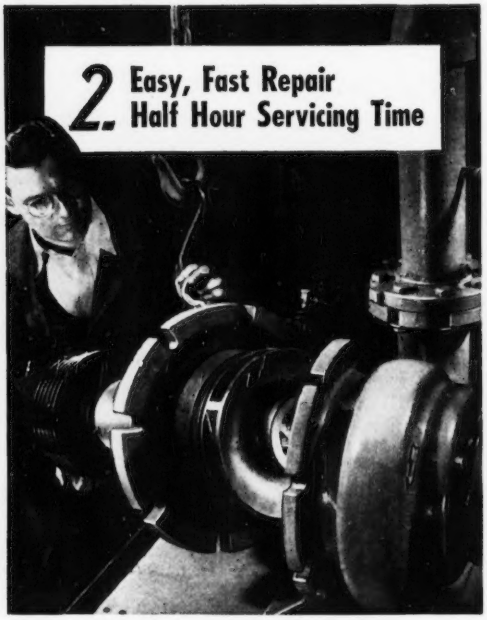
NORTHWEST

Convertible for any Mining Material Handling or Excavation Problem

Save 2 Ways

With Allis-Chalmers Solids-Handling Pumps!





THIS IS WHAT TYPICAL METALLIC and non-metallic material processors say about A-C solids-handling pumps.

"Best previous pump had life of ten days. Most rapidly wearing part of A-C pump has life about ten times as long at about same initial cost."

"Previous pump cost $300 per month maintenance. Our A-C solids pump has had no service in nine months."

"Pump life had been about 80 hours with best pump obtainable. A-C solids-handling pump now runs 350 hours."

Here is proof that Allis-Chalmers solids handling pumps *actually deliver the* long service promised for them; proof that they actually do cut pumping costs.

SAVES ON UPKEEP, TOO

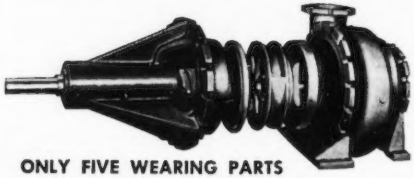
Every solids-handling pump, regardless of type, requires regular replacement of wearing parts. The A-C solids-handling pump makes this job easy, fast and economical.

Dismantling and reassembling takes a half hour or less. Wearing parts are separated and only worn parts need be replaced. Three sets of bearings, brackets and shafts cover all pump sizes, reducing inventory of spare parts as much as 2/3.

EXPERT APPLICATION ENGINEERING

When you buy, a skilled pump application engineer makes sure you have the *right* pump for your needs. Contact your nearest A-C Sales Office or write for Bulletin 6381.

A-2764



ONLY FIVE WEARING PARTS

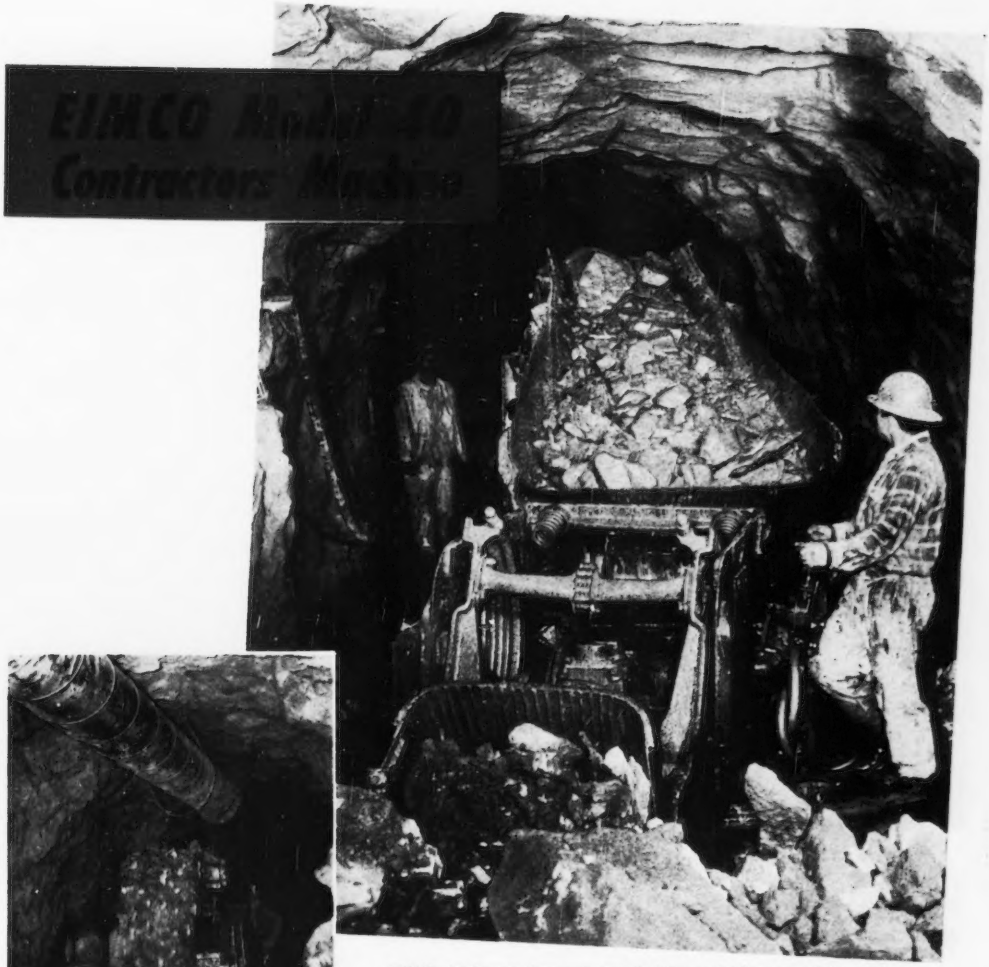
Shaft sleeve, impeller, casing, two wear plates. All easy to handle and easy to replace.

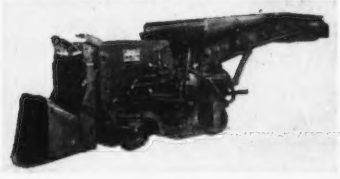
A-C ALLIS-CHALMERS

ALLIS-CHALMERS, 969A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

EIMCO Model 40
Contractors' Machine





ABOVE: An Eastern Contractor speeds his tunnel job to completion with a Model 40 Eimco RockerShovel. LEFT: Full belts of muck load the cars quickly. LEFT BELOW: The Eimco Model 40 RockerShovel.

The Eimco Model 40 RockerShovel has proven again that Eimco RockerShovels increase footage at lower cost than any other piece of loading equipment in any size tunnel.

Let Eimco Engineers help you plan your tunnel jobs. Experienced tunnel men for mines or contract jobs are at your service. No obligation.

EIMCO

THE EIMCO CORPORATION

"The World's Largest Manufacturers of Underground Rock Loading Machines"

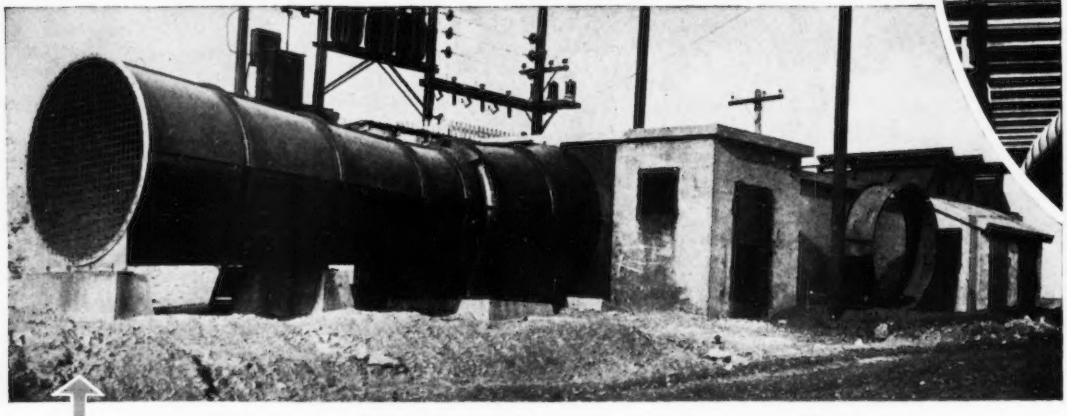
EXECUTIVE OFFICES AND FACTORIES: SALT LAKE CITY 8, UTAH, U. S. A.
BRANCHES: NEW YORK, CHICAGO, BIRMINGHAM, EL PASO, BERKELEY, IRONWOOD

AFFILIATED COMPANIES: SOCIETE EIMCO, PARIS, FRANCE
EIMCO, GREAT BRITAIN, LTD., LEEDS 12, ENGLAND
AGENTS IN ALL PRINCIPAL CITIES THROUGHOUT THE WORLD

AE13

JOY AXIVANE*

GIVE YOU TOP EFFICIENCY WITH ANY LENGTH OF TUBING



IF MAIN VENTILATION is your Problem

JOY AXIVANE* MINE FANS

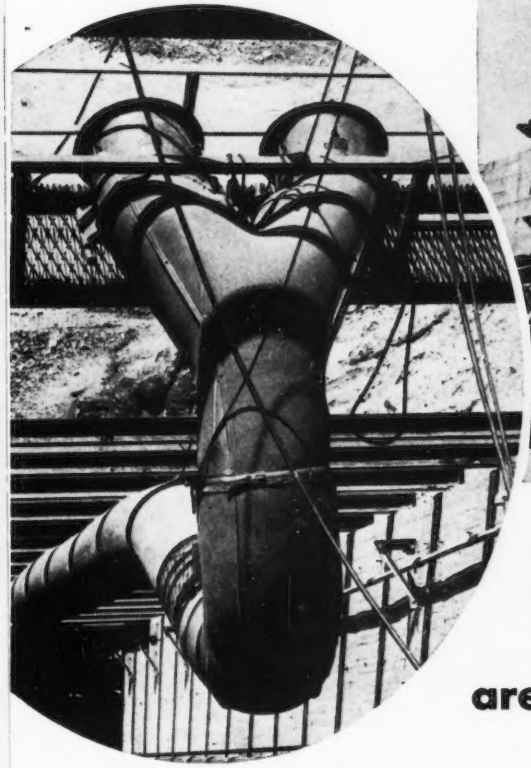
GIVE YOU MORE AIR AT FAR LOWER COST

*Trade Mark Reg. U.S. Pat. Off.

Right: a twin installation of Type I-21 JOY AXIVANE Blowers at a large metal mine.

BLOWERS

Below: the same twin units, looking down. Left, opposite page: a typical JOY AXIVANE Exhaust Mine Fan installation, at another metal mine.



JOY BLOWERS

are *All-Purpose* units

With the *vaneaxial* design, pioneered by JOY in mine ventilation equipment, you secure the great advantage of unmatched efficiency over the widest possible operating range. JOY AXIVANE Blowers give you top performance in either high or low pressure service. You don't need different types of blowers for different lengths of ventilation tubing, and you eliminate blower replacement when the tubing length must be changed. What's more, JOY Blowers are compact and space-saving, operate more quietly, provide smoother air flow and require minimum power. ● Let JOY solve your air supply problems . . . there are types and sizes of AXIVANE Blowers and Fans to meet every mine ventilation requirement.

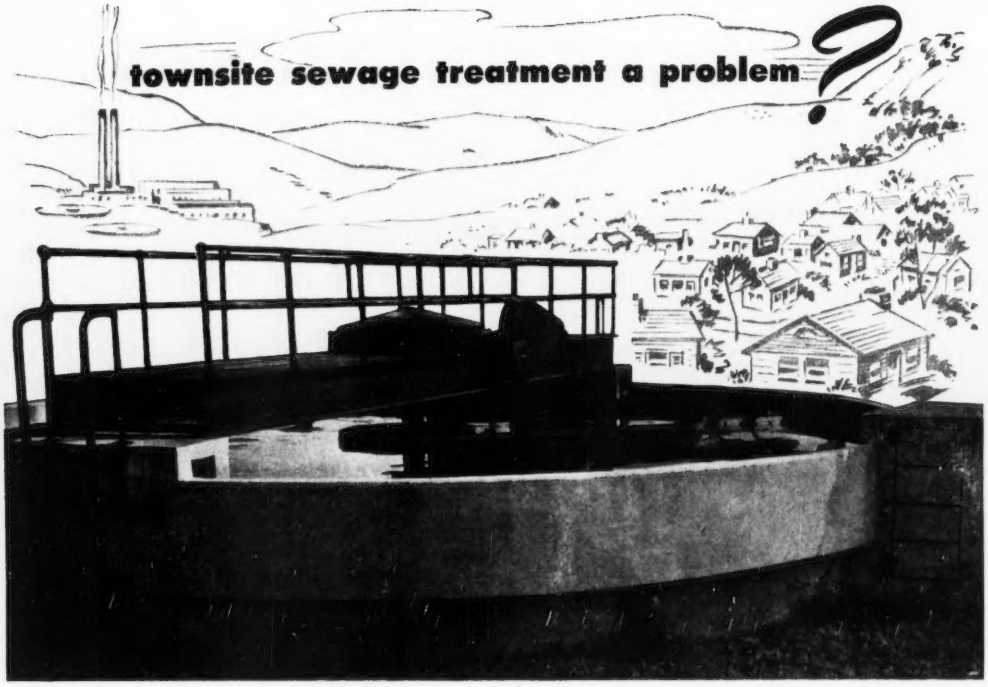
Write for Bulletin, or *Consult a Joy Engineer*

W & D M 2349

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO



Get HIGH EFFICIENCIES AT LOW COST with the Dorr Clarigester

EXPRESSLY DESIGNED to serve small populations, the Dorr Clarigester is the ideal answer to dependable, low cost sewage treatment for the plant community. A "two-in-one" unit, it combines a Dorr Clarifier mechanism in the top compartment with a Dorr Digester mechanism in the lower . . . both built into an attractive, compact structure. It retains all the advantages of the Imhoff tank, but eliminates unsightly floating scum, lack of control and costly construction.

Completely mechanical operation is the key to Clarigester efficiency. Clarification and scum removal take place in the upper compartment . . . homogeneous digestion, and sludge collection in the flat-bottomed lower compartment. A special one-way trap or seal prevents the passage of gas or sludge liquor upward from the lower to the upper compartment. Heating coils may be installed to promote optimum digestion temperatures with hot water usually supplied by a small coal, gas or oil fired boiler.

Available in sizes from 10 to 40 feet dia., the Dorr Clarigester is ideally adapted to the requirements of mining town populations. No other unit brings to such small communities the uniform and controllable results that come from mechanical sedimentation and digestion.

Write for Bulletin #6691-C for further information . . . or better still, let a Dorr engineer explain the Clarigester to you in terms of your own problem.

DORRCO

THE DORR COMPANY, ENGINEERS
570 LEXINGTON AVE., NEW YORK 22, N. Y.
ATLANTA • TORONTO • CHICAGO
DENVER • LOS ANGELES
RESEARCH AND TESTING LABORATORIES
WESTPORT, CONN.
SUGAR PROCESSING
PETREE & DORR DIVISION, NEW YORK 22, N. Y.
ASSOCIATES AND REPRESENTATIVES
Dorr Technical Services and Equipment Are Also Available Through Associated Companies and Representatives In the Principal Cities of the World. Names and Addresses on Request.

DORR
RESEARCH ENGINEERING EQUIPMENT

Like two tires in one!

HERE'S the double-duty pit and quarry tire specially built to handle two jobs. ON the road it rolls long and smooth, pays off on mileage—OFF the road it gives super-traction. It's Goodyear's new, improved Road Lug.

The Road Lug's alternately spaced lug bars are big and husky—bite right in on dirt and other unpaved surfaces for positive traction. But when it hits the highway, its long continuous center strip gives smooth rolling, long economical mileage.

This remarkable dual-purpose tire has extra-strong carcass and undertread—tapered grooves between the lugs to prevent the picking up and holding of stones—wider spaced, deeper lug bars. Put all these outstanding features together in one tire and you have the perfect tire for pit and quarry hauling—Goodyear's new, improved Road Lug. Remember, always BUY and SPECIFY Goodyear—*it pays!*

The Super-Stamina Tire
For OFF-THE-ROAD Hauling
The HARD ROCK LUG

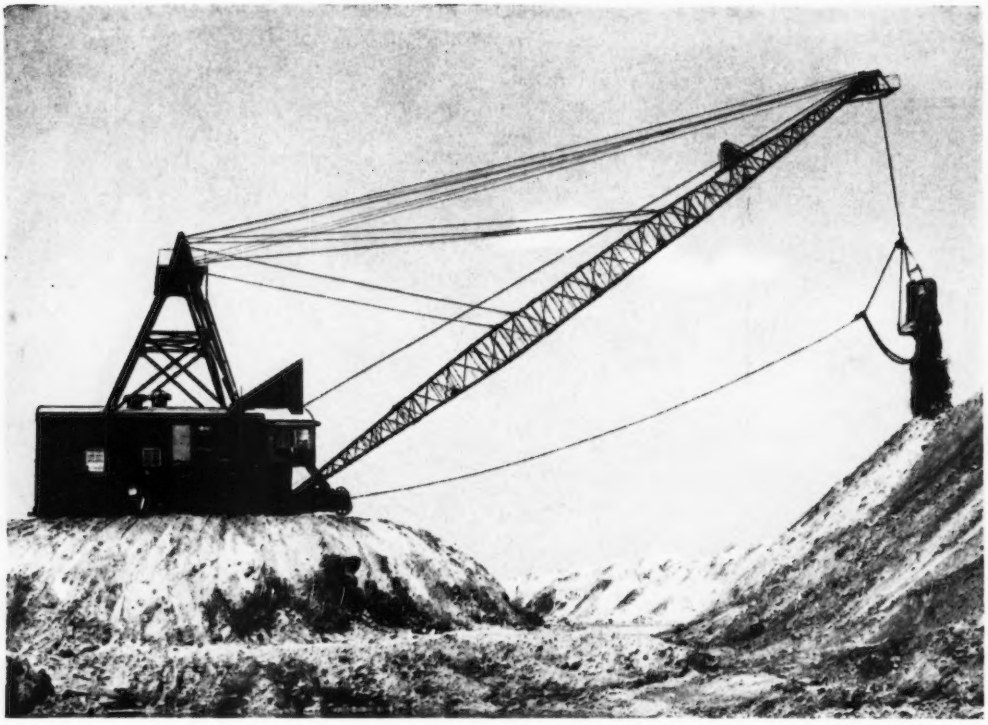
This extra-husky tire is best for all OFF-THE-ROAD *tire-ripping, tire-bruising jobs. Ask your Goodyear dealer about it now!*

We think you'll like "THE GREATEST STORY EVER TOLD"—Every Sunday—ABC Network

Road Lug—T.M. The Goodyear Tire & Rubber Company

GOODYEAR

MORE TONS ARE HAULED ON GOODYEAR TIRES THAN ON ANY OTHER KIND



An Appetite for Overburden

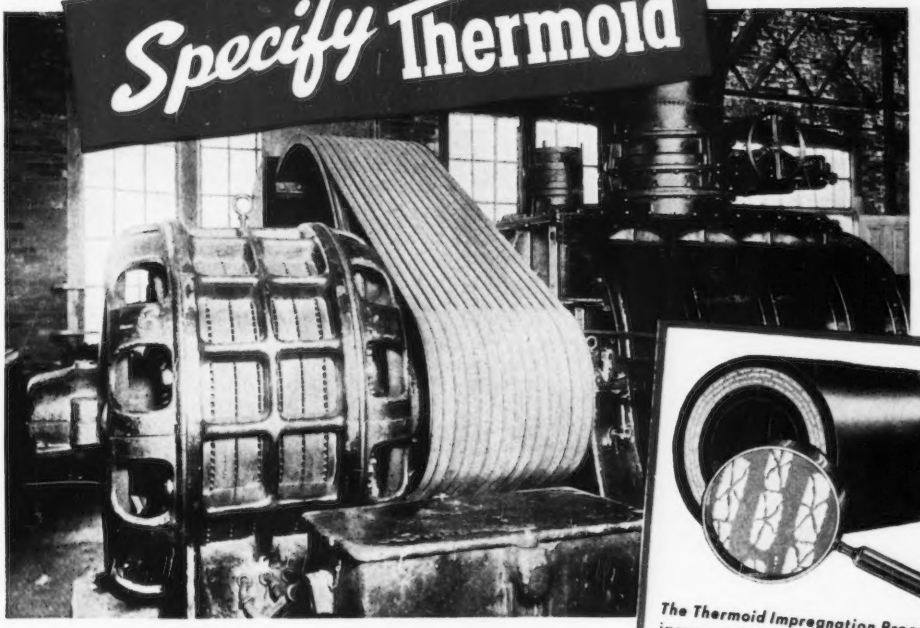
Where overburden is the problem, the answer is a Bucyrus-Erie walking dragline like the 7 to 10 cubic yard 9-W pictured above . . . for Bucyrus-Eries offer a line-up of job-proved features that mean big output wherever they go to work. Simple, sturdy design and construction mean reliable operation — important when working far from repair facilities. A dependable, strong walking mechanism means exceptional maneuverability, a smooth walking action without jerks or shocks — so Bucyrus-Eries can always work in the most effective digging and dumping positions, can move safely and surely over loose sand, soft ground, around obstacles. Long ranges and fast operating cycles mean big yardage capacities — the "appetite for overburden" that spells profitable operation. Bucyrus-Erie walking draglines are offered in a wide variety of bucket sizes and boom lengths to fit your job requirements.

BUCYRUS ERIE

SOUTH MILWAUKEE, WISCONSIN

38M49

Specify Thermoid



The Thermoid Impregnation Process insures a deeper penetration of rubber between the threads of the yarn, which encases each individual strand with protective rubber. The rubber acts as a sheath between the strands and prevents the destructive abrasive action as the product is flexed in use. To obtain the required rubber penetration, the twist of the yarn must be to exact specifications. With the yarn twisted too tightly, proper penetration of the rubber compound is impossible. This condition produces abrasion, causing premature failure. On the other hand, if the yarn is twisted too loosely, the product lacks tensile strength. Thermoid has discovered the optimum twist of the yarn which assures maximum rubber penetration and greatest strength. The development of Thermoid Impregnation Process is another step forward in Thermoid's planned program of product improvement, assuring maximum service and lower operating costs to industry through the use of Thermoid Industrial Rubber Products.

Thermoid Impregnation Process Assures Longer V-Belt Life

Thermoid V-Belts are built to withstand excess moisture—abrasion—acidity—all those elements that hasten belt deterioration. All Thermoid V-Belts are built for the job . . . from the smallest fractional horsepower size up to the largest multiple V-Belt. Each belt is specifically designed and prestretched to transmit maximum power without slippage, to absorb repeated shock loads; and to provide smooth, efficient performance at the *lowest* possible cost per hour.

A complete range of sizes are available to meet your requirements.

For quick service call the nearest Thermoid distributor. Thermoid sales engineers are available for advice on special problems.

It will pay you to ***Specify*** Thermoid!

Thermoid Quality Products: Transmission Belting • F.H.P. and Multiple V-Belts • Conveyor Belting • Elevator Belting • Wrapped and Molded Hose • Molded Products • Industrial Brake Linings and Friction Materials.

Thermoid Company

Main Offices and Factory • Trenton, N. J., U. S. A.
Western Offices and Factory • Nephi, Utah, U.S.A.
Industrial Rubber Products • Friction Materials • Oil Field Products

Step by Step

AGITAIR

is planned and engineered to fit your flotation job

Problem analysis . . . Galigher design and construction engineers and metallurgists establish flow sheet fundamentals and provide a smooth working plan.

Construction . . . every Agitair is custom-built to fit the job and its construction embodies all the original basic features of Agitair flotation.

Installation . . . expert operators and mechanics install, start-up and check performance of your Agitair installation.

Follow-through . . . periodic inspections and consultations insure a dependable and profitable operation.

"Leaders in Experience and Service"

THE GALIGHER COMPANY

METALLURGICAL DIVISION ENGINEERING SERVICE

CONSULTATION • ORE TESTING • PLANT DESIGN • CONSTRUCTION

AGENTS IN ALL PRINCIPAL FOREIGN MINING DISTRICTS

HOME OFFICE
545 WEST 34th SOUTH
SALT LAKE CITY, UTAH
P. O. BOX 209

EASTERN OFFICE
921 BERGEN AVENUE
JERSEY CITY,
NEW JERSEY

Any Way You Figure It

(Slide rule, calculus, counting on your fingers)...

Bethlehem Wire Rope Means Low Cost per Unit of Work

Actually, it's as simple as 2 + 2 = 4. All you do is divide the purchase price of the rope by the total units of work it does in its life. The answer, of course, is cost per unit of work—the only *real* measure of wire rope economy.

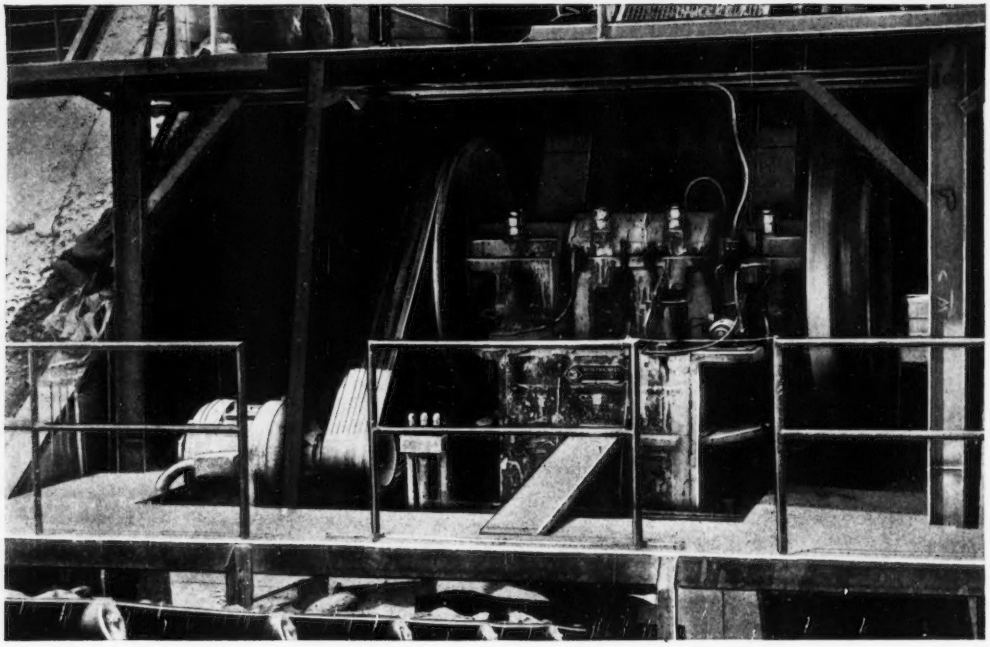
What is a unit of work? It can be a ton of rock moved by a power shovel. Or a car of coal hauled up a slope. Or a ton-mile in oil-country rotary drilling. These are but three examples; there are many others. It isn't difficult to record, or closely estimate, the amount of work that a wire rope accounts for. That total will be high—and the unit cost *low*—when your choice is a Bethlehem rope.

It isn't first cost that determines whether a wire rope is expensive or economical. The rope labeled "Bargain" is frequently quite the reverse. You've found a bargain only when the rope cost is low with respect to the useful work accomplished.

On this basis—the only true yardstick—Bethlehem rope is a genuine "buy." Every foot, every inch of it, is built for service. . . built to give you *low* cost per unit of work. You can order it with confidence.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation



Azusa Rock & Sand Co. Cuts Costs with "*A-1*" Jaw Crusher

CALLED "ONE OF THE most efficient crushing plants in the country," Azusa Rock & Sand Co. of California installed this 42x32 in. *"A-1"* jaw crusher to break gravel boulders, some as large as 30 inches. Feed runs 100 to 200 TPH; sometimes as high as 250 TPH.

Heavy-going demands like this have been everyday routine, six days a week, for this Allis-Chalmers machine since 1946. Yet, the original main bearings are still going strong. Operation has been practically trouble-free. Only jaw plates and toggle bearings have been replaced.

MANPOWER ECONOMY

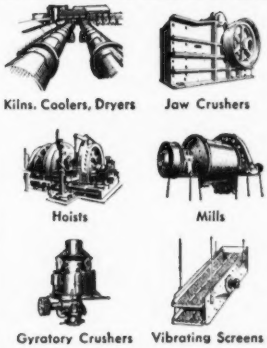
Convenient all-electric controls regulate feeder, crusher and belt conveyor to surge pile. All controls are sequence interlocked. Only one operator is needed.

CHECK THESE "A-1" FEATURES

- No choking or packing in the "A-1" jaw crusher — crushing is uniformly distributed throughout the entire depth of the crushing chamber.
- Jaw opening nips biggest pieces with minimum slippage.
- Renewable parts protect expensive castings from wear, greatly prolong crusher life.
- Automatic lubrication of main pitman and swing jaw bearings.

Find out more about *"A-1" jaw* crushers and other Allis-Chalmers crushers from the A-C representative in your area. Or write for **Bulletin 07B6369A.** Allis-Chalmers offices or distributors are in principal cities in the U.S.A. and throughout the world.

A-2817



AND OTHER EQUIPMENT FOR THE CRUSHING, CEMENT AND MINING INDUSTRIES

ALLIS-CHALMERS, 969A SO. 70 ST.
MILWAUKEE, WIS.

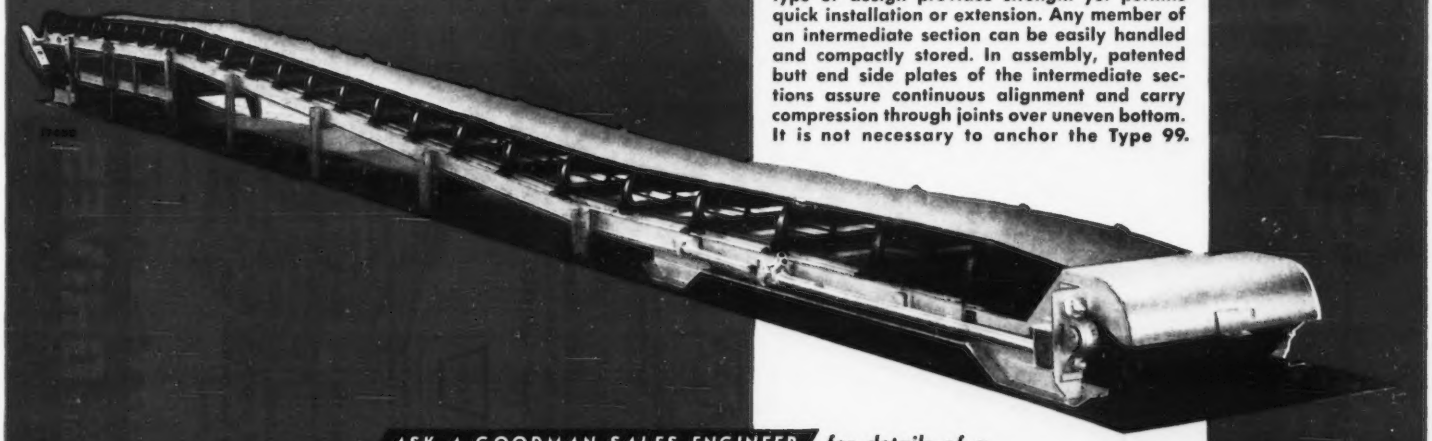
"A-1" is an Allis-Chalmers trademark.

ALLIS-CHALMERS

GOODMAN *TYPE 99* UNDERGROUND BELT CONVEYORS

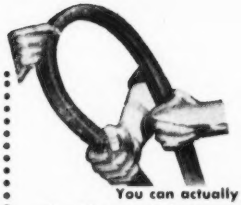
FOR METAL MINE SERVICE

An extendable conveyor specially designed and built for moving heavy ore any practical distance. Bolted "knockdown" type of design provides strength yet permits quick installation or extension. Any member of an intermediate section can be easily handled and compactly stored. In assembly, patented butt end side plates of the intermediate sections assure continuous alignment and carry compression through joints over uneven bottom. It is not necessary to anchor the Type 99.



ASK A GOODMAN SALES ENGINEER *for details of a conveyor in the Type 99 series to suit your mine conditions.*

GOODMAN MANUFACTURING COMPANY • HALSTED STREET AT 48TH • CHICAGO 9, ILLINOIS



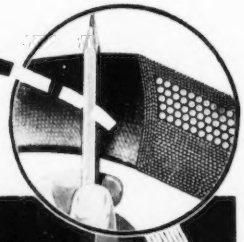
You can actually **feel** the sides of a belt **change shape** as the belt bends.

In Two Minutes You Can See Exactly How . . .

The Concave Side

(U.S. Patent No. 1813698)

SAVES Your Transmission DOLLARS



Take *any* V-belt in your hands and bend it as it bends in going around a pulley. You will see that the top of the belt, being under *tension*, grows *narrower*. The body, under compression, *widens*. The sides *bulge out*.

This shape change—in a *straight-sided* V-belt—is shown in Figures 1 and 1-A, below.

Straight-Sided V-Belt

How Straight-Sided V-Belt Bulges in Sheave-Groove.

Now look at Figures 2 and 2-A. There you see how the *same shape change* affects the V-belt built with the precisely engineered *Concave Side* (U.S. Patent No. 1813698).

Gates Vulco Rope with Concave Side.

No Side Bulge. Precise Fit in Sheave Groove.

The top of the belt narrows, the body widens. But the sides *merely straighten—and* the new shape *exactly fits* the sheave groove!

Two savings result. (1) Uniform side-wall wear *—longer life!* (2) Full side-wall grip on the pulley carries heavier loads and *sudden load increases* without slipping; saves belts, saves *power!*

The Mark of SPECIALIZED Research

The Concave Side is *MORE IMPORTANT NOW Than Ever Before*

Because the sides of a V-Belt are what actually drive the pulley, it is clear that any increased load on the belt means a heavier load that must be transmitted to the pulley directly through the belt's sidewalls.

Now that Gates SPECIALIZED Research has made available to you SUPER Vulco Ropes—carrying fully 40% higher horsepower ratings—the life-prolonging Concave Side is naturally more important in conserving belt life today than ever before.

4910

GATES VULCO ROPE DRIVES
Engineering Offices and Jobber Stocks IN ALL INDUSTRIAL CENTERS of the U. S. and 71 Foreign Countries

THE GATES RUBBER COMPANY
DENVER, U.S.A.
The World's Largest Makers of V-Belts

GET THESE

2 BIG SAVINGS..

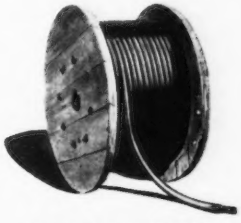
ON POWER CABLE

1 Power cable with Alcoa E.C.* Aluminum conductor costs less. The larger the cable, the bigger the saving.

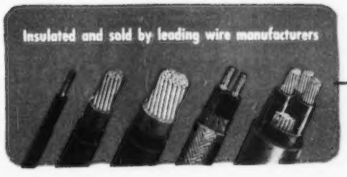
2 Aluminum cable of equivalent current-carrying capacity weighs far less. Needs fewer men to install, less costly supporting structure.

Alcoa makes light, strong, conductive E.C. Aluminum which leading wire manufacturers draw, strand and insulate and sell under their own trademarks. They have it in all popular sizes with insulations that withstand mine waters. Ask your wire supplier about it, or write ALUMINUM COMPANY OF AMERICA, 1476L Gulf Building, Pittsburgh 19, Pennsylvania.

*E.C.: *Electrical Conductor* Aluminum



The BIG DIFFERENCE is in your COSTS!



ALCOA EC ALUMINUM

FOR ELECTRIC WIRE AND CABLE

Facts you should know

about the New General Motors Diesel Engine-Torque Converter Unit

Two 190 H.P. 6 Cylinder GM Diesel Engine-Torque Converter units power the new 34 ton Euclid LFFD tandem axle rear dump. Each engine drives one rear axle, eliminating the conventional inter-axle power divider. A 3-speed Allison Torqmatic transmission does away with the clutch pedal and manual shifting. Designed for off-the-highway haulage of large tonnage, the mammoth LFFD has a top speed of 25.4 m.p.h. with full pay load.

ONE MANUFACTURER ONE RESPONSIBILITY The new torque converter is specifically designed and manufactured by General Motors as an integral unit with the Series 71 two-cycle Diesel engine. Result: a big saving in size and weight—no compromise designs—no divided responsibility.

AUTOMATIC SHIFT FROM TORQUE MULTIPLICATION TO FLUID COUPLING Desirable features and advantages of *both* torque converter and fluid coupling are combined in this converter. Continuous *automatic* transition from 3.6-to-1 torque ratio at stall speed to 1-to-1 torque ratio in fluid coupling. Unit goes into fluid coupling whenever load requirements equal engine torque, without regard to output shaft speed.

MORE WORK IN LESS TIME This new power unit gets the most work done in the least time. Because it is not rigidly geared to the load, the engine responds to the throttle and immediately accelerates to a high output range regardless of the speed of the load.

FREEDOM FROM SHOCK LOADS Transmission of power through a liquid, cushions both engine and driven machinery from sudden shock loads. Operation is liquid-smooth (free from jerks) at any speed or throttle setting.

FREEDOM FROM STALLS WITH OVERLOAD Fluid circuit prevents engine stalling under any load condition. Ability to exert a smooth pull at any output shaft speed down to zero permits GM Converter-equipped machines to do some operations that are impossible with conventional units.

EASE OF HANDLING Eliminates time lost in unnecessary low gear operation. Operator fatigue is reduced. Work is speeded up with less effort on the part of the operator.

WIDE RANGE OF MODELS The new GM Diesel Engine-Torque Converter unit is made available in 3-, 4- and 6-cylinder single engine units, Twin 4 and Twin 6 multiple engine units with engine ratings from 64 to 294 B.H.P. to meet a wide range of power requirements. *Write or wire for full details.*

DETROIT DIESEL ENGINE DIVISION

SINGLE ENGINES... Up to 200 H.P. **DETROIT 28, MICHIGAN** MULTIPLE UNITS... Up to 800 H.P.

GENERAL MOTORS

DIESEL BRAWN WITHOUT THE BULK

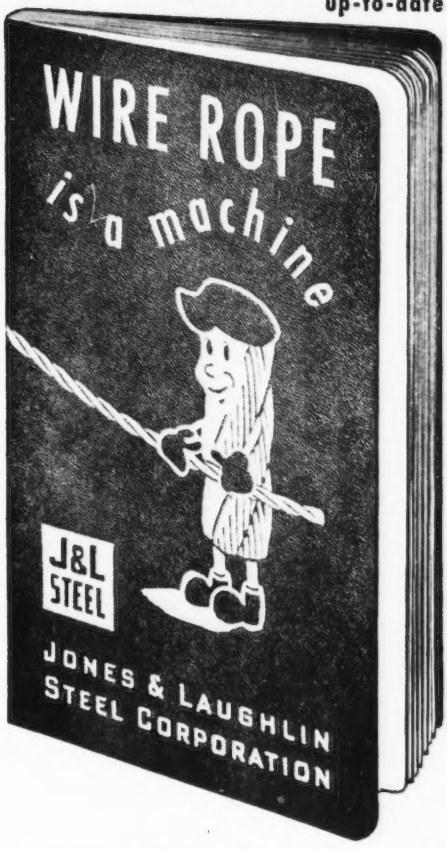
GM GENERAL MOTORS DIESEL POWER

Get your copy of J&L'S NEW WIRE ROPE HANDBOOK

J&L STEEL

for the man on the job

Pocket size • easy to read • up-to-date



Here's the new illustrated J&L Wire Rope Handbook . . . written for the man who handles wire rope *on the job.* It contains 96 pages of information to help *you* get the most out of the wire rope on your machine.

It's easy to understand . . . it has the answers to many of your questions about wire rope . . . it's yours for the asking. Thousands of men have already put this book to good use. Why not send for your copy now?

It tells you about

- **installation and operation**
- **selecting the right rope**
- **J&L wire rope maintenance**
- **standard fittings, slings, and splicing service available with J&L wire rope**

Recommendations for:

Excavating Equipment
Oil Country Uses
Marine Applications
Industrial Needs
Logging Installations

Send the coupon for your copy now!

Jones & Laughlin Steel Corporation
412 Jones & Laughlin Building
Pittsburgh 19, Penna.

Please send me a free copy of the new wire rope handbook entitled "Wire Rope is a Machine."

Name _____

Company _____

Address _____

JONES & LAUGHLIN STEEL CORPORATION

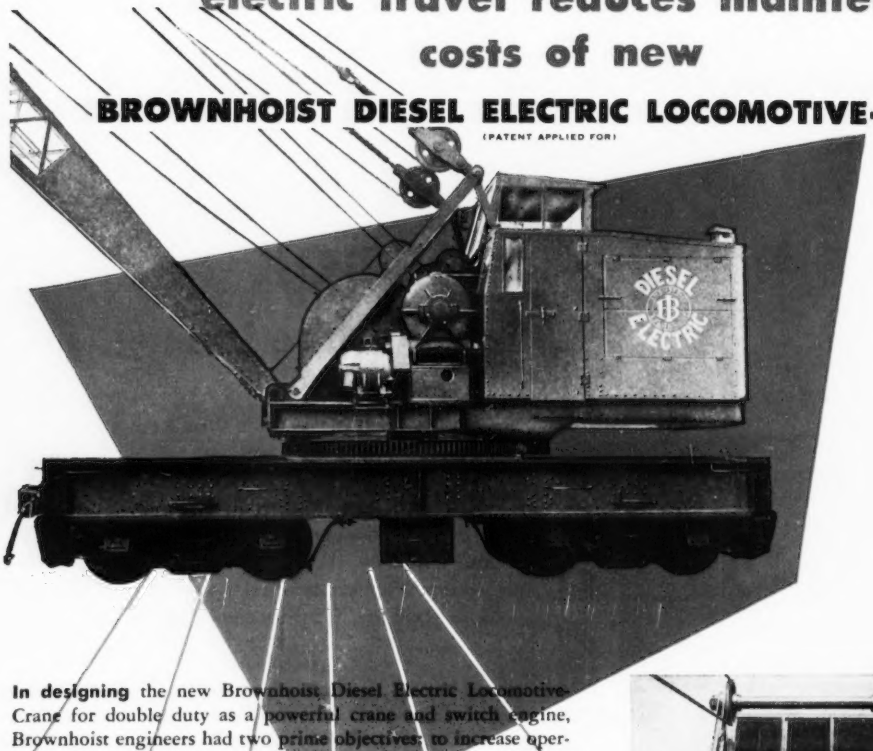
From its own raw materials, J&L *manufactures a full line of carbon steel products, as well as certain products in* OTISCOLOY *and* JALLOY *(hi-tensile steels).*

PRINCIPAL PRODUCTS: HOT ROLLED AND COLD FINISHED BARS AND SHAPES • STRUCTURAL SHAPES • HOT AND COLD ROLLED STRIP AND SHEETS • TUBULAR, WIRE AND TIN MILL PRODUCTS • "PRECISIONBILT" WIRE ROPE • COAL CHEMICALS

electric travel reduces maintenance costs of new

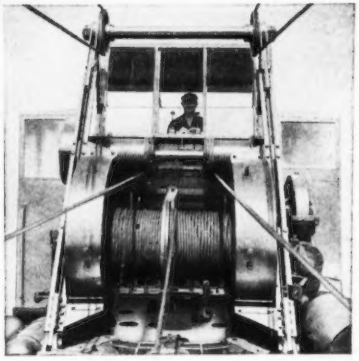
BROWNHOIST DIESEL ELECTRIC LOCOMOTIVE-CRANE

(PATENT APPLIED FOR)



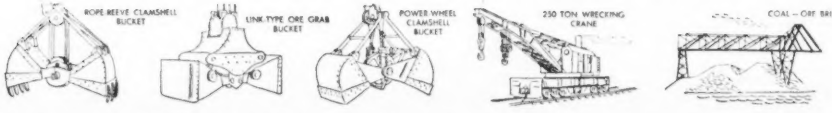
In designing the new Brownhoist Diesel Electric Locomotive-Crane for double duty as a powerful crane and switch engine, Brownhoist engineers had two prime objectives: to increase operating efficiency and reduce maintenance costs. The new Brownhoist Diesel Electric supplies *travel power directly to the axles from two oversize spring-mounted motors hung inside the AAR cast steel side frame trucks. Power for hoist, swing, and booming is transmitted through a helical gear reducer.* Simple, efficient, practically trouble-free!

These are only two of the many *money-saving, labor-saving, time-saving* features engineered into the Brownhoist Diesel Electric Locomotive-Crane. Others include the patented Monitor-type cab that affords the operator 360° visibility—travel speeds up to 15 M.P.H.—double disc roller bearing mounted rotating clutches —roller bearing boom tip sheaves—14″ safety clearance between car body and rotating bed—safe worm driven boom hoist. Capacities 30 tons and up. Write for complete facts that will show you how to *speed and simplify your material handling at lower costs.*



This view shows how travel clutch shafts and operating gear have been eliminated from the Brownhoist Diesel Electric Locomotive-Crane. Note 360° vision Monitor-type cab with hoist and boom drums in full view of operator.

BROWNHOIST BUILDS BETTER CRANES


ROPE REEVE CLAMSHELL BUCKET
LINK-TYPE ORE GRAB BUCKET
POWER WHEEL CLAMSHELL BUCKET
250 TON WRECKING CRANE
COAL – ORE BRIDGE

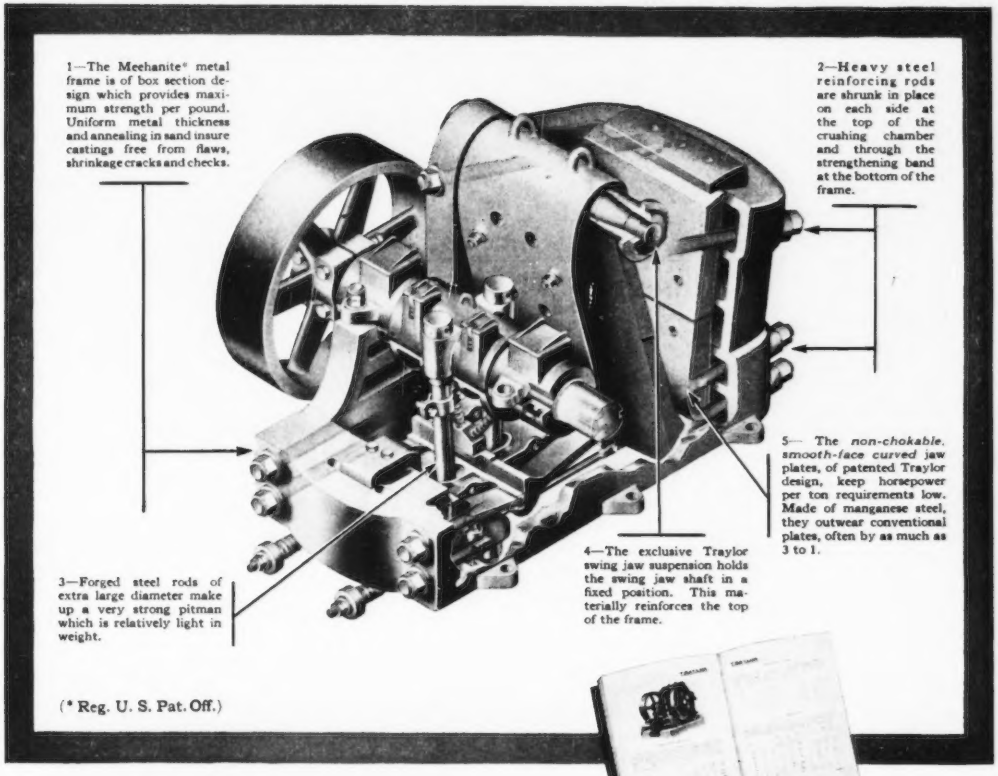
INDUSTRIAL BROWNHOIST CORPORATION • BAY CITY, MICHIGAN

DISTRICT OFFICES: NEW YORK, PHILADELPHIA, CLEVELAND, CHICAGO • **AGENCIES:** DETROIT, BIRMINGHAM, HOUSTON, LOS ANGELES, PORTLAND, SAN FRANCISCO, SEATTLE, SPOKANE, CANADIAN BROWNHOIST LTD., MONTREAL, QUEBEC.

CURVED JAWS...

FOR GREATER CRUSHING EFFICIENCY IN THE TRAYLOR TYPE R JAW CRUSHER

This cut-away of a Traylor Type R Crusher shows clearly the advanced design characteristic of all Traylor-built equipment. Each feature contributes to larger profits through higher production with lower power and maintenance costs. The Type R Crusher, built in five sizes up to 56″ x 72″, is completely described in illustrated Bulletin 123 shown below.


1—The Meehanite* metal frame is of box section design which provides maximum strength per pound. Uniform metal thickness and annealing in sand insure castings free from flaws, shrinkage cracks and checks.
2—Heavy steel reinforcing rods are shrunk in place on each side at the top of the crushing chamber and through the strengthening band at the bottom of the frame.
3—Forged steel rods of extra large diameter make up a very strong pitman which is relatively light in weight.
4—The exclusive Traylor swing jaw suspension holds the swing jaw shaft in a fixed position. This materially reinforces the top of the frame.
5— The *non-chokable, smooth-face curved* jaw plates, of patented Traylor design, keep horsepower per ton requirements low. Made of manganese steel, they outwear conventional plates, often by as much as 3 to 1.
(* Reg. U. S. Pat. Off.)

TRAYLOR

JAW CRUSHERS

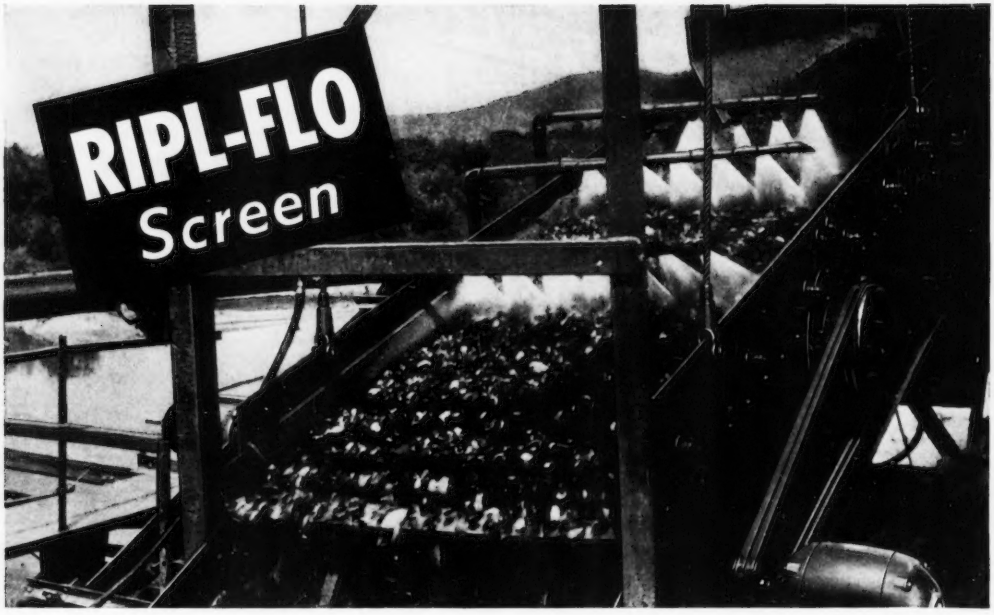
Gyratory Crushers · Reduction Crushers
Feeders · Kilns · Coolers · Dryers
Grinding Mills · Crushing Rolls

Write today for your copy of Bulletin 123. See how curved jaw plates can increase your profits by reducing your crushing costs.

TRAYLOR ENGINEERING & MANUFACTURING CO.
204 Mill St., Allentown, Pa.

Canadian Mfrs: Canadian Vickers, Ltd., Montreal, P. Q.

A "Traylor" Leads to Greater Profits



"Easiest to Change Cloth ...Has Largest Capacity"

THAT'S THE ENTHUSIASTIC statement of Mr. Gilman Carter, of Twin States Sand & Gravel Co., West Lebanon, N. H., about this 4 x 10 ft double deck *Ripl-Flo* screen.

Used for sizing and washing crushed gravel and sand, this Allis-Chalmers vibrating screen produces 100 TPH of accurately graded products—sometimes feed runs to 150 TPH.

It's loaded to capacity constantly. Yet, after three years' operation, the only repair has been replacing rubber strips for supporting screen surfaces.

Changing or tensioning screen cloth is done quickly, by means of clamping plates conveniently located on outside of screen body — easy to get at.

Ripl-Flo screen's true circular motion to every part of screen surface results in rapid stratification, with no "dead" spots anywhere on cloth area. That's why, size for size, you'll get top screening capacity with this screen.

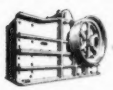
CHECK THESE *RIPL-FLO* FEATURES

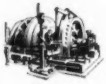
- Has only two bearings to lubricate instead of four.
- Offers 17% less width; as much as 36% less weight than comparable screens.
- Adequate support for screen surfaces increases cloth life.
- Simplified design reduces maintenance, power, initial costs.
- Sizes 3x6 to 6x16 ft; 1 to 4 decks.

Get in touch with the Allis-Chalmers representative in your area for more facts about *Ripl-Flo* screens. Or write for **Bulletin 07B6151B.** A-C offices or distributors are in principal cities in the U.S.A. and throughout the world.

Ripl-Flo is an Allis-Chalmers trademark.

Kilns, Coolers, Dryers


Jaw Crushers


Hoists

Mills

Gyratory Crushers

Vibrating Screens

AND OTHER EQUIPMENT FOR THE CRUSHING, CEMENT AND MINING INDUSTRIES

ALLIS-CHALMERS, 969A SO. 70 ST.
MILWAUKEE. WIS.

ALLIS-CHALMERS A2839

WICKWIRE ROPE

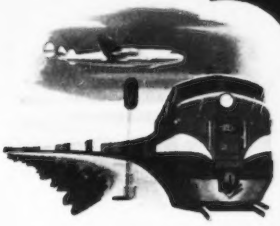
A PRODUCT OF CF&I

Ask any user . . . you'll find them everywhere

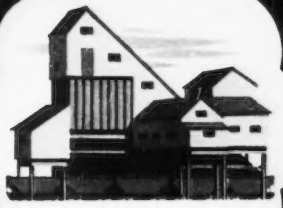
In scores of industries, users of Wickwire Rope have developed an affectionate respect for its performance, safety and long life. And, for true economy, they use Wickwire's WISSCOLAY® Preformed. It lasts longer — is easier to cut, splice and install. It's kink-resistant and safer to handle. Wickwire Distributors and Rope Engineers, in key cities everywhere, are prepared to render prompt service in meeting your wire rope needs. Wickwire Rope Sales Office and Plant — Palmer, Mass.

IN THE EAST—Wickwire Spencer Steel Div. of C. F. &.
500 Fifth Ave., New York 18, N. Y.
IN THE ROCKIES—The Colorado Fuel and Iron Corp.
Continental Oil Bldg., Denver, Colo.
ON THE WEST COAST—The California Wire Cloth Corp.
1080—19th Ave., Oakland 6, Cal.

LOGGING

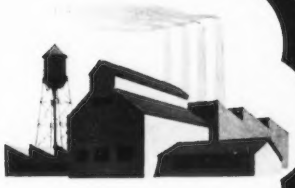


TRANSPORTATION

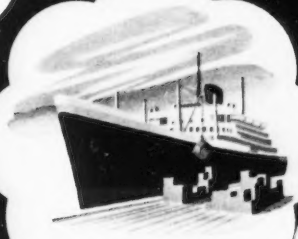


MINING

PETROLEUM



MANUFACTURING



MARINE

CONSTRUCTION

A. E. Brotman

G-200R Wagon Drills, mounting 4" drifters, run 24-foot blast holes

fast drilling at any angle

The flexible mounting of the versatile G-200R Wagon Drill adapts it for drilling vertically, horizontally, or at any desired angle — line drilling, toe-hole drilling or bench drilling. The sliding cone, with a 36-inch adjustment, offsets ground irregularities or uneven steel lengths.

The G-200R provides fast and easy operation of the more powerful CP drifter drills — with great reduction in drilling costs. Its CP rotary air motor gives a steady feed and quick return, with plenty of power for pulling tight steel.

The wheels can be quickly turned at right angles (tandem) to facilitate line drilling or drilling close to ledge or wall.

Available with CP-50N (3"), CP-60N (3½"), or CP-70 (4") drifters.

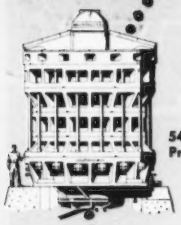
CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

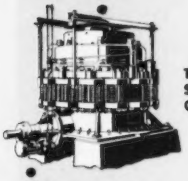
PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

Another Prominent Mining Company Selects

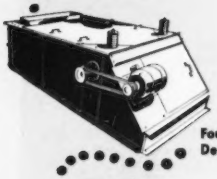
NORDBERG *throughout!*



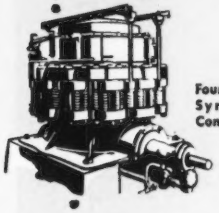
54" super-heavy Nordberg Primary Gyratory Crusher.



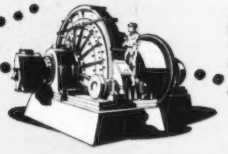
Two 7-foot super-heavy Symons Standard Cone Crushers.



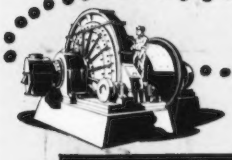
Four 5' x 8' Symons Rod Deck Screens.



Four 7-foot super-heavy Symons Short Head Cone Crushers.



Two 10'8" x 17'0" Nordberg (Primary) wet grinding Mills.



Two 10'8" x 17'0" Nordberg (Secondary) wet grinding Mills.

TOTALLY destroyed during World War II, the Sydvaranger iron ore crushing and concentrating plant at Kirkenes, Norway, far above the Arctic Circle, one of the world's outstanding pioneer *taconite* operations, is now being reconstructed.

Nordberg Equipment has been selected for all stages of Crushing, Screening and Grinding. The ore is an extremely hard, laminated magnetite, quite similar to the American magnetic *taconites* of the Lake Superior district.

Nordberg is supplying the Sydvaranger Company with an extra heavy duty 54" gyratory for primary breaking . . . the strongest gyratory of this size ever built.

The world renowned Nordberg SYMONS CONE CRUSHERS, which had been used by Sydvaranger in their former operations, have again been chosen for secondary and tertiary crushing. These are all of Superheavy 7-ft. size in Standard and Short Head types. Symons Rod Deck Screens are being installed for scalping service.

To obtain a high grade of concentrate, very fine grinding is necessary, and in addition to the extra heavy duty Symons Cone Crushers, Nordberg Heavy Duty Primary and Secondary Ball Mills, 10'8" dia. x 17'0" long, are being installed.

Wherever mining is done, you'll always find Nordberg equipment the first choice of experienced operators. Nordberg Mining and Milling machinery to meet *your* requirements includes Mine Hoists, Gyratory and Jaw Crushers for primary crushing; Symons Cone Crushers for second and third stage crushing; Vibrating Bar Grizzlies; Symons Rod Deck Screens and Horizontal Vibrating Screens for sizing; a complete line of Ball, Tube and Rod Grinding Mills; and a complete line of Nordberg Diesels for dependable, low cost power production.

Write for literature on the equipment you need.

NORDBERG MFG. CO.

MILWAUKEE 7, WISCONSIN

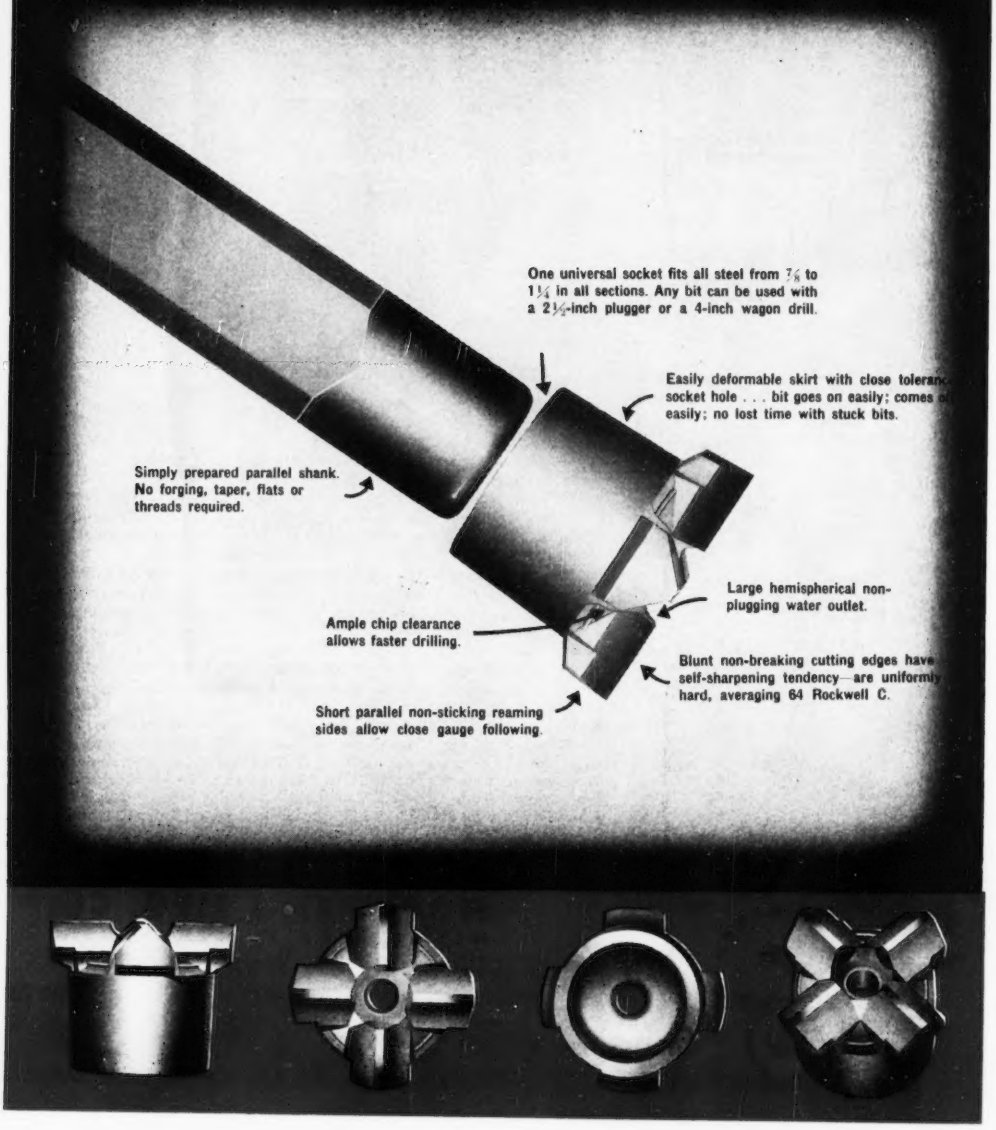
NEW YORK • SAN FRANCISCO • WASHINGTON • SPOKANE
MEXICO, D.F. • LONDON • TORONTO • JOHANNESBURG

NORDBERG

Machinery for processing ores and industrial minerals

THROWAWAY

DETACHABLE ROCK BITS


One universal socket fits all steel from ⅞ to 1¼ in all sections. Any bit can be used with a 2½-inch plugger or a 4-inch wagon drill.
Easily deformable skirt with close tolerance socket hole . . . bit goes on easily; comes off easily; no lost time with stuck bits.
Simply prepared parallel shank. No forging, taper, flats or threads required.
Large hemispherical non-plugging water outlet.
Ample chip clearance allows faster drilling.
Blunt non-breaking cutting edges have self-sharpening tendency—are uniformly hard, averaging 64 Rockwell C.
Short parallel non-sticking reaming sides allow close gauge following.

SOME NEW *Throwaway Tools* FOR CONTRACTORS AND MINERS

The Throwaway 1¼" Socket Carbide Bit

Suitable for Wagon Drills

As revolutionary in design as the Throwaway steel bit, these bits will take just as much of a beating, will cut rock fast, have large chip clearance and may be re-ground several times to give hundreds of feet of economical drilling.

Made in all sizes from 3" to 2" with 1/16" gauge changes.

The Throwaway Standard 1" Socket Steel Bit

Suitable for Wagon Drills, Drifters, Jackhammers, and Stopers

This is the old favorite which has been used for millions of feet of fast, economical drilling all over the world. Used on any type or size of steel, machined, ground or forged to fit its 1" socket.

Sizes from 2¼" to 1 9/16" with 1/16" guage changes. (Available also in carbides.)

The Throwaway ⅞" Socket Steel Bit

Suitable for Jackhammers and Stopers

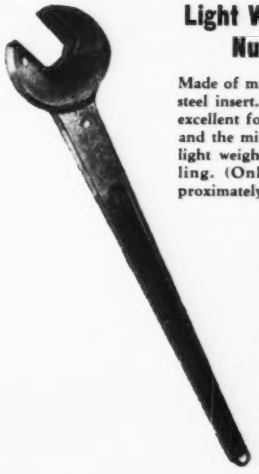
These bits were primarily designed for roof suspension bolt holes and generally for use with ⅞" hexagon or quarter-octagon steel.

Sizes 1 9/16" to 1 ¼" with 1/16" guage changes. (Available also in carbides.)

Knock-Off Bars

Type 1 ¼, Type 1 and Type ⅞.

These tools of our exclusive design are standard and universally used throughtout the industry for removing non-threaded rock bits.



Light Weight Saddle Nut Wrench

Made of magnesium with a tool steel insert. These wrenches are excellent for setting up drifters, and the miners appreciate their light weight and ease of handling. (Only 3¼ pounds, approximately 26" long.)

Light Weight Scaling Bars

Made in 8, 10, and 12 ft. lengths, magnesium with tool steel head. Much easier on the miner than old type steel bars. Weight approx. 3½ to 5 lb.

Fully descriptive literature on all products is available. Competent field engineers are always at your service.

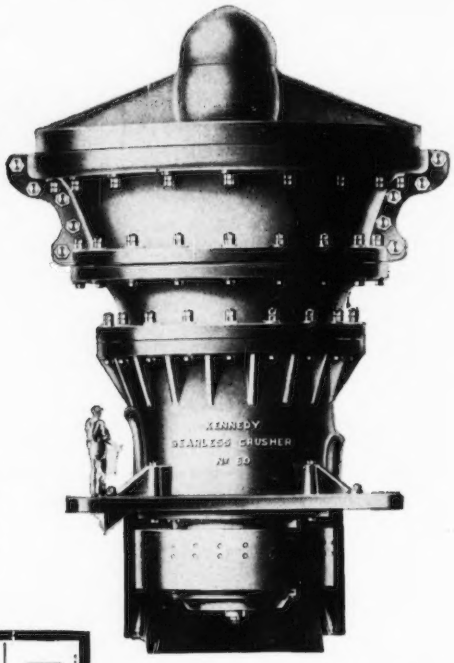
Some territories still open for distributors and jobbers.

THROWAWAY BIT CORPORATION

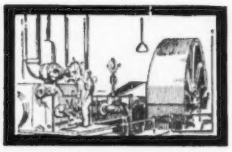
4200 N.W. Yeon Ave. Portland, Oregon, U.S.A.

Throwaway Bits, methods of manufacture, etc., and the name Throwaway are covered by patents already issued, applications for patents, design patents, trademarks, etc. Any infringement will be prosecuted to the full.

WANT FREE CRUSHING POWER?

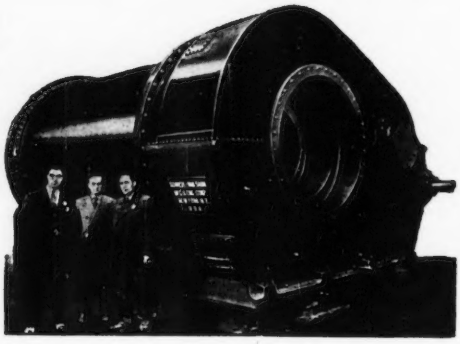


Ever hear of Kinetic energy? It's the extra power that results when a big pulley or flywheel whirls around—like the big pulley on the old Corliss Engine. Well, KINETIC ENERGY is exactly what gives you ADDED FREE POWER in the "KVS" Gearless Crusher, for no added cost. We whirl a BIG pulley in the KVS Gearless! It whirls around at a speed of 3,500 ft. pr minute—and what EXTRA crushing energy or crushing power you get! What's more, the 8-ton pulley (used in a KVS Crusher weighing 400,000 lbs.) whirls so easy you can turn it WITH TWO FINGERS! If there were a bevel gear between the eccentric and the pulley, it would take SIX MEN with crowbars to turn it. In short, more CRUSHING for LESS POWER COST, is the idea that puts KVS way out in front, and keeps it there!



• *Send for the* **NEW "KVS" BULLETIN**

WANT TO SAVE $6,000?



Say you're buying a 10 ft. tube or ball mill. And suppose you decide on a "KVS" with integral gear drive. The Kennedy INTEGRAL GEAR DRIVE enables motor to be DIRECT CONNECTED to driving shaft. Shaft is carried in roller bearings that CANNOT be misaligned or set wrong. The pinion shaft to which the motor is connected runs at approximately 600 r.p.m. while other pinion shafts run at about 180 r.p.m. ON A 10 ft. MILL THIS ENABLES YOU TO PURCHASE THE SYNCHRONOUS MOTOR AT A SAVING OF ABOUT $6,000. Another point to remember is—"KVS" trunnions on large sized tube and ball mills are CARRIED ON OIL. The bearing never wears out, uses little power. All gears and bearings are automatically sprayed with oil before tube mill is started (Design patented). Believe it or not, in 15 years no "KVS" gears or pinions have worn out on this type mill.

"THE PRODUCTS WITH THE TROUBLES LEFT OUT...

WANT TO BE CONVINCED?

SPEAKING OF CRUSHING . . . .

LOCATION: NATIONALLY KNOWN MINING CO.
NEW YORK STATE

CRUSHERS: FOUR NO. 37½ KENNEDY TYPE "S"
ROLLER BEARING GYRATORY CRUSHERS

FEED OPENING: 6¼"; **DIAMETER OF HEAD:** 3 FEET

DISCHARGE SETTING: 7/32" CLOSED SIDE AT HEAD

CAPACITY EACH CRUSHER:
56 TONS PER HOUR

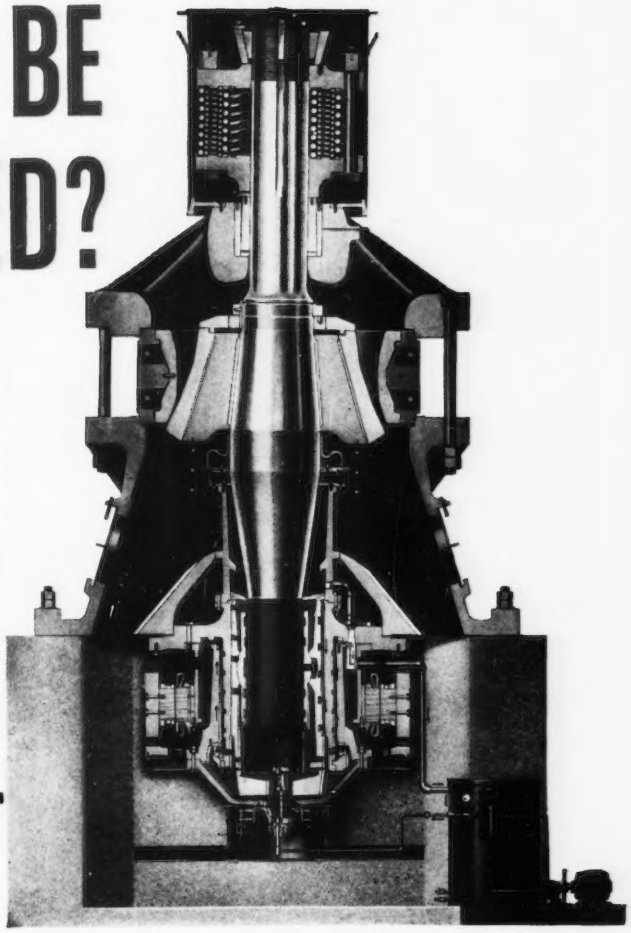
HORSEPOWER EACH CRUSHER: 48 HP.

CLOSED CIRCUIT OPERATION
GRADATION AS FOLLOWS:

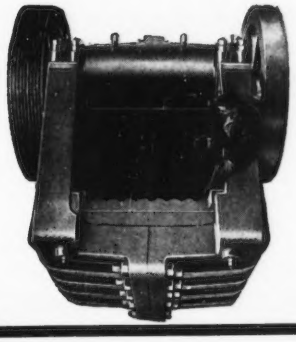
THE FIGURES!

99.8%	Minus	3	MESH
93.3	"	4	"
80.6	"	6	"
66.6	"	8	"
56.1	"	10	"
48.1	"	14	"
40.6	"	20	"

Can You Equal These Figures?



WANT TO KNOW HOW?

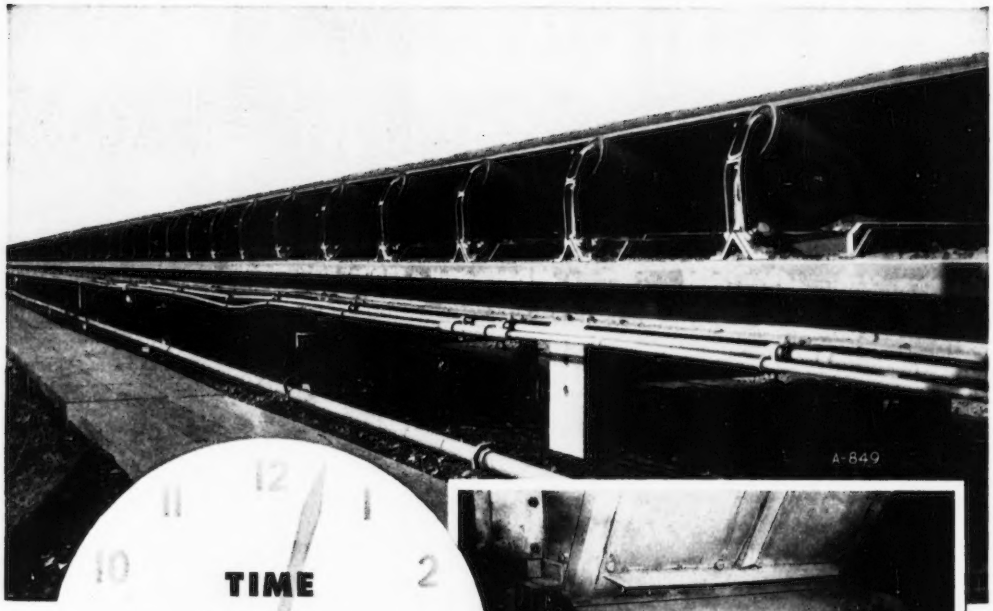


How can the "KVS" Swing Jaw Crusher do MORE crushing and yet use LESS POWER than ordinary swing jaw crushers? Well, we'll tell you. The angle of both swing jaw and stationary jaw is THE SAME. Stationary jaw carries fully 50 percent of load . . . result, you need LESS POWER to keep the swing jaw swinging and crushing. Note another thing—the swing jaw is all ONE PIECE, except renewable crushing plate. Also swing and stationary jaws are interchangeable, both the same length, and reversible end-for-end, giving twice as much crushing life before renewal is needed.

Kennedy-Van Saun
MANUFACTURING AND ENGINEERING CORPORATION

2 PARK AVE., NEW YORK 16, N. Y.

FACTORIES:
DANVILLE, PA., U. S. A.
CANADA, ENGLAND, FRANCE, AUSTRALIA



TIME SAVER ...for an ORE DOCK

While lake steamers are idle during winter months, this S-A equipped handling system at a large Great Lakes' ore dock speeds the reclaiming of ore stockpiled during the summer. A 1200 foot long belt conveyor eliminates need for constant bridge travel up and down the yard . . . saves time by conveying ore direct from bridge to car loading point . . . from any part of storage area.

Nearly 50 years of experience with bulk handling problems enables S-A engineers to design and equip conveying systems that save time, simplify operations and reduce handling costs. If you have a bulk handling problem, put it up to S-A for recommendations. Write us today . . there's no obligation.

GREAT LAKES ORE DOCK

Traveling ore bridge can reclaim ore from any section of storage area and place it into receiving hopper to discharge to 1200 foot long conveyor belt that extends thru the entire storage area. Hopper is mounted on leg of bridge which straddles belt conveyor. From hopper, an S-A "AMSCO" Pan Feeder feeds ore to the belt. Another pan feeder is located under the 100-ton capacity surge bin fed by the main belt and feeds ore to a 50-ton weigh hopper discharging directly to rail cars.*

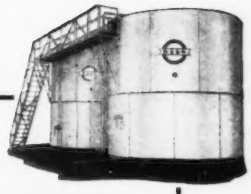
*T.M. Reg. American Brake Shoe Co.

STEPHEN S-A DAMSON MFG. CO.

4 Ridgeway Avenue, Aurora, Illinois · Los Angeles, Calif. • Belleville, Ontario

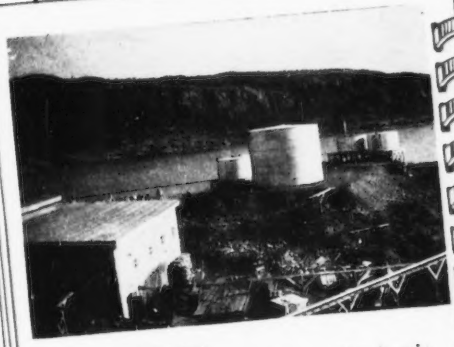
DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

BS&B Bolted Tanks



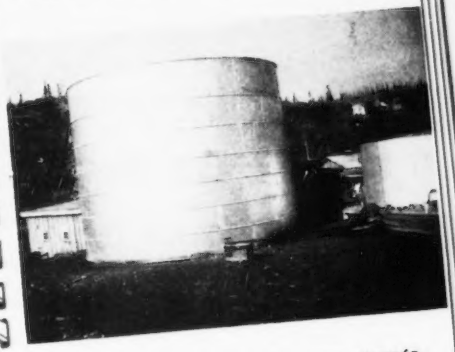
. . . pack 'em in a plane, slide 'em in a sled, cart 'em in a canoe . . .

Quick, Safe Storage Anywhere



RADIUM . . . near the Arctic Circle on Great Bear Lake! Far into the wilds . . . but not too far for the Black, Sivalls & Bryson Sales Engineer. By barge, by canoe and by sled, even by plane, parts were assembled for the Bolted Tanks serving this El Dorado Gold Mines location.

Though the trip took two months, erection was speedy, even with untrained help. Arctic storms, freezes and thaws have failed to affect its tightness. Yes,



BS&B Bolted Tanks give you storage, *anywhere!*

Remember, here's the tank that can go wherever you can go. And they've proved their versatility . . . on oil, water, aviation gasoline, even grain and cement!

Soundly engineered, weather-proof and tight against leaks. Standard sizes from 100 to 10,000 barrels capacity.

MAIL COUPON NOW . . . get the complete story for yourself! EXPORT SHIPMENTS A SPECIALTY

BS&B BOLTED TANKS

BLACK, SIVALLS & BRYSON, INC., Section BTM-9
720 Delaware Street, Kansas City 6, Mo.

Send me full particulars concerning the use of BS&B Bolted Tanks in my business. We do ..... mining.

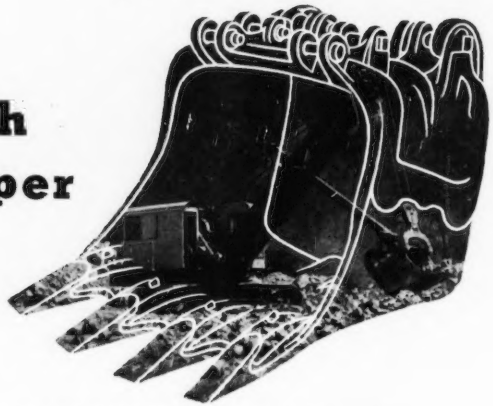
NAME .....

FIRM .....

ADDRESS .....

CITY ..... STATE .....

A Good Shovel Works Better with an Amsco Dipper



Made of austenitic manganese steel for resistance to impact, pressure, and abrasion, Amsco dippers also provide the advantages of fast, full loading and quick, complete dumping. Design of Amsco dippers is based on an experience of forty years in fields of power shovel application. To make a good shovel work better, specify an Amsco dipper. Available in all standard capacities, up to ten cubic yards . . . and in types as outlined below.

AMSCO RENEWABLE LIP DIPPER

A strong, long-life dipper, designed for low overall cost. Patented Amsco construction makes it possible to replace worn lip quickly, holding down-time to a minimum. Teeth are also renewable and reversible.

AMSCO WELDED TYPE DIPPER

Designed to meet the demand for a strong durable dipper at minimum weight . . . for fast digging and economical use of power. Built in two types: Two Part (1½ to 2 yards) and Four Part (2 yards and up); sections are joined by Amsco's patented plug welding process, with all joints overlapped for rigidity. Teeth reversible for double duty . . . and replaceable.

AMSCO DIPPERS for Special Purposes

AMSCO manufactures the famous Missabe Dippers and a wide range of cast manganese steel dippers and buckets for pull-shovels and underground work . . . as well as dippers of any design to meet any particular application.

AMSCO PARTS

AMSCO supplies cast manganese steel dipper and shovel parts, including: teeth, renewable lips, bails, racks and pinions, sheaves, gears, crawler parts . . . as well as a complete line of welding products for hardfacing and reclamation.

For full information on Amsco Dippers and parts—write for Bulletin 547-DS.

AMERICAN Brake Shoe COMPANY

AMERICAN MANGANESE STEEL DIVISION
CHICAGO HEIGHTS, ILL.

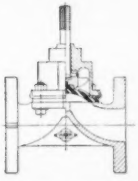
Foundries at Chicago Heights, Ill., New Castle, Del., Denver, Colo., Oakland, Calif., Los Angeles, Calif., St. Louis, Mo. Offices in principal cities. In Canada: Joliette Steel Limited, Joliette, Que.

NEW! Grinnell-Saunders Diaphragm Valves *power operated* by Bendix-Westinghouse Rotochambers

dependable power operation and remote control

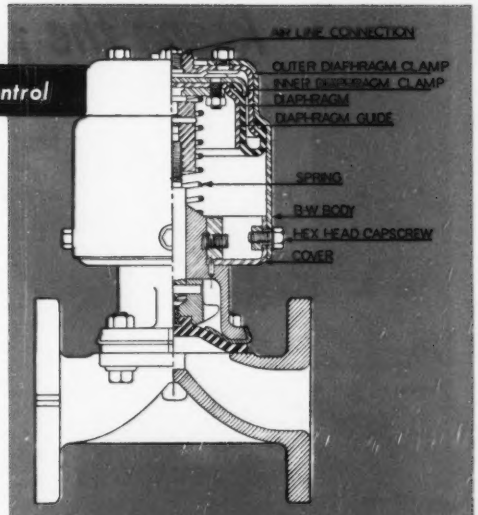
FEATURES:

- Bendix-Westinghouse Rotochamber top-works has rolling sleeve type of seal . . . leakproof and practically frictionless. No packing glands and no lubrication required.
- Pressed steel cylinder is neat looking, light and compact. Height of 2″ flanged air-to-close valve from center line to top is only 9¾″; air-to-open valve (in open position) is 14⅛″.
- Bendix-Westinghouse top-works has been tested up to seven million strokes without any sign of wear or failure.
- Top-works may be operated with air or hydraulic pressures up to 105 pounds. For pressures up to 100 pounds in the line being controlled, an actuating pressure of only 50 pounds is required under average conditions. Pressure reducing valves are not required for pressures up to 105 pounds because of adjustable stem travel stops incorporated in the valve bonnet design.
- Adjustment is easily made without removal of top-works from valve body.

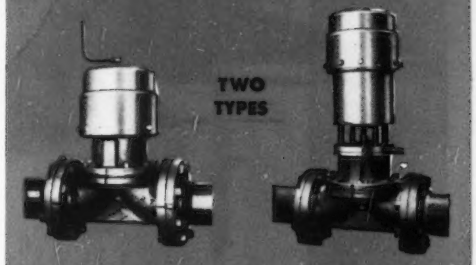


Sliding stem bonnet assembly is suitable for use with other valve motor units. Sliding stem bonnets are interchangeable with other bonnet designs.

YOU GET THESE ADVANTAGES IN ANY GRINNELL-SAUNDERS DIAPHRAGM VALVE: Diaphragm isolates working parts from the fluid, preventing corrosion of these parts and contamination of the fluid; diaphragm opens wide for streamlined flow; diaphragm presses tight for positive closure, even with suspended solids in the line; body, lining and diaphragm materials to meet service conditions; simple maintenance.



air to close, spring to open



4″ air to close, spring to open

4″ air to open, spring to close

GET THE WHOLE STORY on this and other Grinnell-Saunders Diaphragm Valves. Send coupon below for new Catalog 4-S, just out.

Grinnell Company, Inc.
268 West Exchange St.
Providence 1, R. I.

Please send me a copy of your new Catalog 4-S of Grinnell-Saunders Diaphragm Valves.

Name .....

Company .....

Address .....

.....

99 YEARS PIPING

GRINNELL

As mining looks to the future...

GARDNER-DENVER

keeps the pace!

Wherever the mines of tomorrow are located — whatever the mining methods — you'll find Gardner-Denver fine quality mining tools on the job. For throughout the mining world, Gardner-Denver equipment is famous for that extra measure of performance that often makes the difference between waste rock and pay dirt.

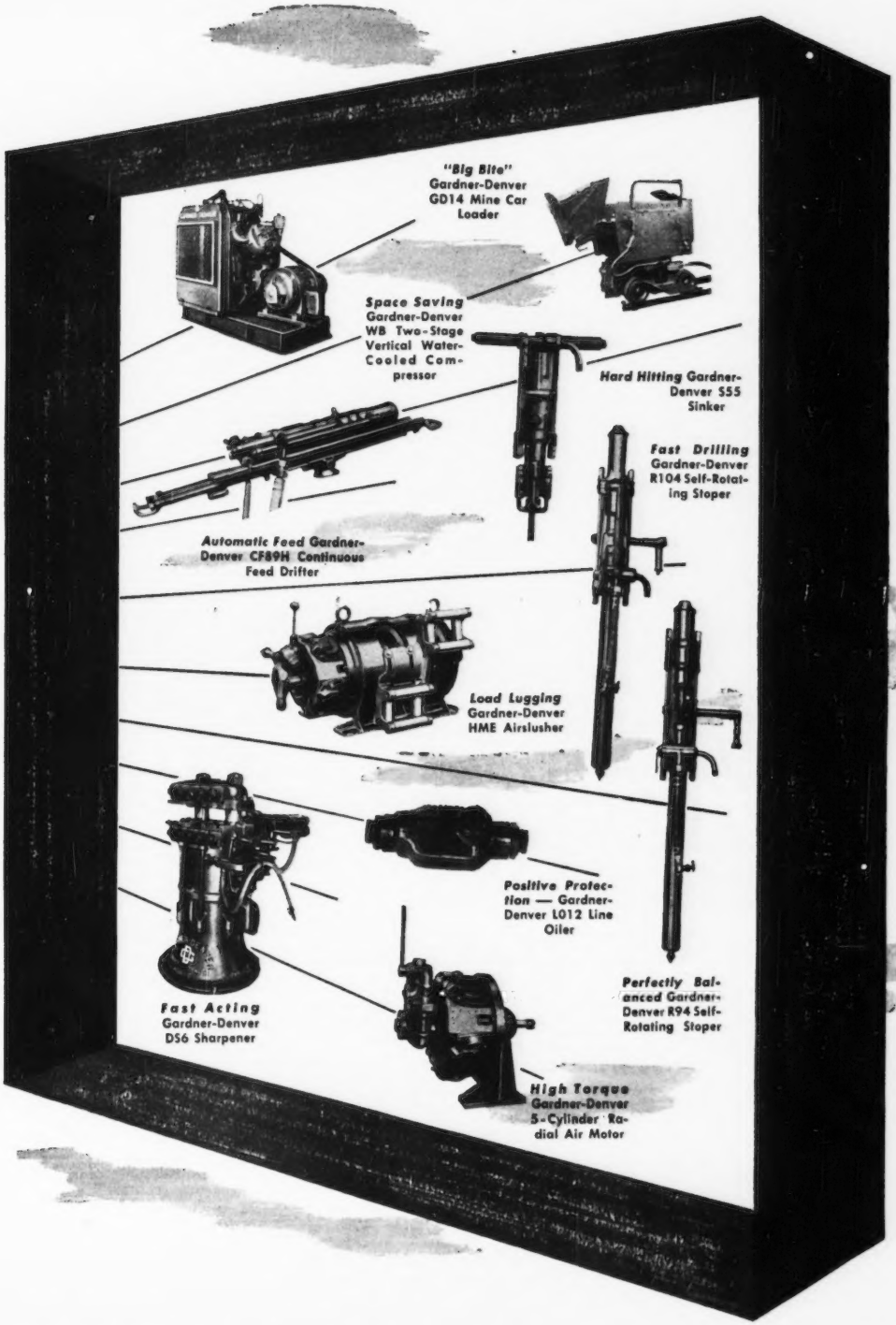
Gardner-Denver — familiar with problems of the constantly expanding mining industry — keeps the pace with new and improved machines that help you increase mining efficiency.

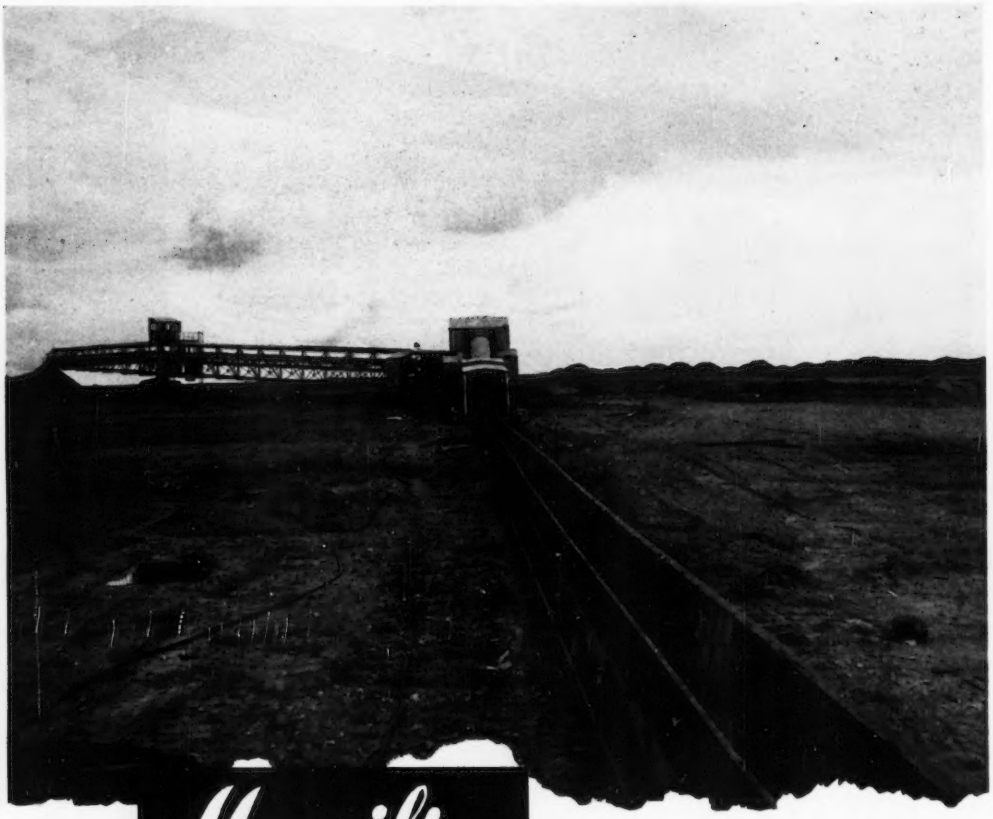
For further information on the popular Gardner-Denver models shown here, write us today!

GARDNER-DENVER Since 1859

Gardner-Denver Company, Quincy, Illinois

In Canada: Gardner-Denver Company (Canada) Ltd., Toronto, Ontario


"Big Bite" Gardner-Denver GD14 Mine Car Loader
Space Saving Gardner-Denver WB Two-Stage Vertical Water-Cooled Compressor
Hard Hitting Gardner-Denver S55 Sinker
Fast Drilling Gardner-Denver R104 Self-Rotating Stoper
Automatic Feed Gardner-Denver CF89H Continuous Feed Drifter
Load Lugging Gardner-Denver HME Airslusher
Positive Protection — Gardner-Denver L012 Line Oiler
Perfectly Balanced Gardner-Denver R94 Self-Rotating Stoper
Fast Acting Gardner-Denver DS6 Sharpener
High Torque Gardner-Denver 5-Cylinder Radial Air Motor



Hamilton
RUBBER PRODUCTS

Meet the Rugged Specifications of the Iron Range:

Here—a big, rugged job being done by HAMILTON Belting! At this Minnesota mine 85,000,000 cubic yards of overburden are being removed.

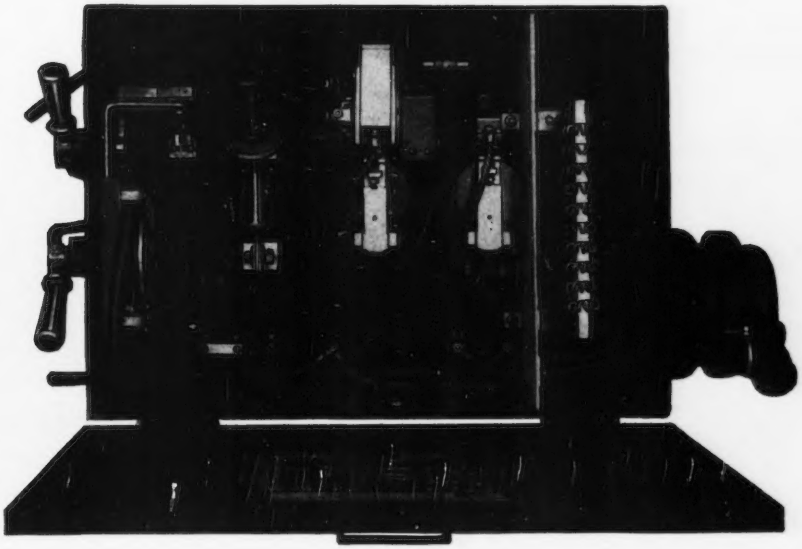
Throughout all industry HAMILTON Rubber Products are known for their wear-ability, performance, and economical cost. You also can save by using HAMILTON Products.

Send for our Catalogue #EM.

1870
H
HAMILTON RUBBER MANUFACTURING CORP.
TRENTON · NEW JERSEY

NEW YORK CHICAGO PITTSBURGH INDIANAPOLIS HOUSTON LOS ANGELES SAN FRANCISCO

DROWNED FOR FIVE DAYS-



Yet the O-B Starter is Ready for Work

Five days completely submerged in mine water—and no damage done. Nothing to replace, nothing to be dismantled and baked dry.

That was the recent experience of a southern mine with an O-B Type-BD Motor Starter. One section of the mine flooded, covering all the equipment, including a BD Starter. Five days later the section was pumped out and the electrical equipment was taken out.

Everything had to be baked for several days before the equipment could be used —except O-B's BD Starter. It was allowed to dry normally for a few hours and put right back into service.

We certainly don't recommend this kind of a bath as standard practice for O-B Motor Starters. But it does prove once again that the simple, rugged construction of O-B Starters really stands up under hard mine service.

O-B Motor Starters are available in both gasproof and open types. Write for complete information.

3018-M

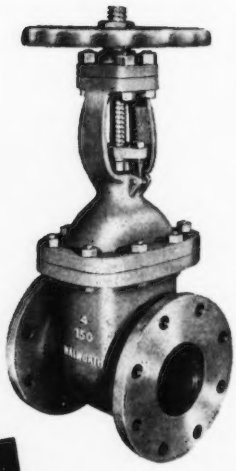
Specify O-B Motor Starters For All Motor-Driven Equipment—They're Designed to Stand Up Under Heavy Mining Service.

Ohio Brass

MANSFIELD, OHIO

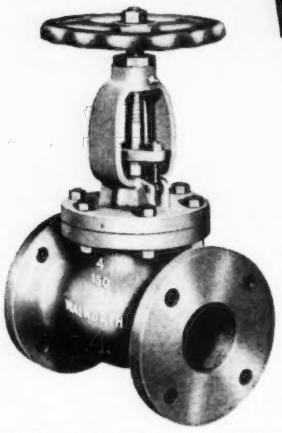
CANADIAN OHIO BRASS COMPANY, LTD
NIAGARA FALLS, ONTARIO

Newly Designed Walworth Valves to combat corrosion



Walworth 150-pound Stainless Steel Gate Valve . . . available in sizes ½ to 3-inch, screwed; ½ to 12-inch, flanged.

Made of Stainless Steel
Monel · Nickel
Acid-resisting Bronze
Ni-resist



Walworth 150-pound Stainless Steel Globe Valve . . . available in sizes ½ to 3-inch, screwed; ½ to 6-inch, flanged.

Sectional view of Walworth 300-pound Stainless Steel Gate Valve . . . available in sizes 2 to 6-inch, flanged.

— ENGINEERED AND TESTED FOR TOUGH . . . HARD SERVICE

Walworth offers a comprehensive line of valves made of several cast stainless steels and special alloys for piping services where corrosion is a factor. These valves are available in Gate, Globe, Angle, Check, and Lubricated Plug types.

Gate, Globe and Angle Valves have outside screw and yoke construction, thus keeping the stem threads out of contact with the corrosive material in the line. They also have a two-piece bolted gland with ball-type gland follower to prevent binding the stem when packing bolts are tightened. Gland eye-bolts can be conveniently swung out of the way without danger of loss when the gland is lifted for repacking.

Gate Valves have taper seats with a unit consisting of two flat faced discs supported by a carrier on the end of the stem. The discs are of a proven ball-and-socket type. They are free to rotate and adjust themselves to the body seat angles, assuring tight seating with no possibility of sticking in any position.

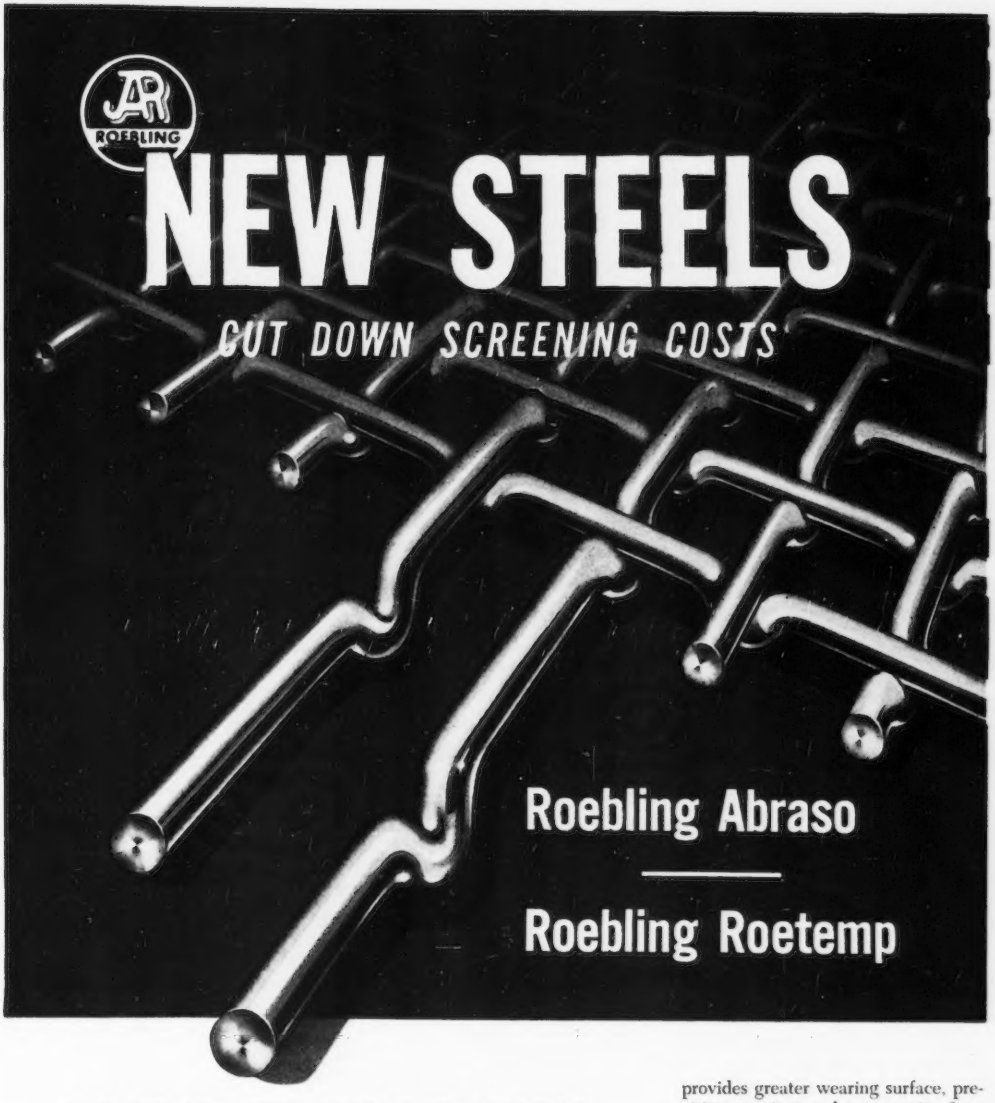
For further information about Walworth's full line of corrosion-resistant valves, see your Walworth distributor.

WALWORTH

valves and fittings

60 EAST 42nd STREET, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD



LONGER LIFE FOR AGGREGATE SCREENS

NOW ROEBLING MAKES two types of steel wire that will save you plenty of screening dollars. They're called "Abraso" and "Roetemp", and they were developed expressly for aggregate screen service. "Abraso" is a special-analysis hard-drawn wire with high resistance to vibration fatigue. "Roetemp" is an oil-tempered wire with top resistance to abrasion. Both wires are exceptionally hard and tough.

Abraso and Roetemp steel wires are woven into Roeton, Roeslot and square mesh screens with ⅝ inch space and larger. All these screens are made in Roebling's Roeflat construction which provides greater wearing surface, precision openings and comparative freedom from clogging. In smaller sizes, other constructions can be furnished.

We invite you to try screens woven from Abraso and Roetemp steel wire and to compare them with the screens you are now using. And take the first step towards screening economy *today* —write for Roebling's Aggregate Screens Catalog.

WOVEN WIRE FABRICS DIVISION
OF JOHN A. ROEBLING'S SONS COMPANY
ROEBLING, NEW JERSEY

ROEBLING
☆ A CENTURY OF CONFIDENCE ☆

IT'S ALL THE SAME TO A BAKER BULLDOZER

Any job...*any* condition a Baker Bulldozer takes it in stride. There's built-in brute strength for the toughest going; fast acting, simplified hydraulic control; positive down pressure; plus perfect balance that utilizes every ounce of tractor power. No wonder Baker Bulldozers and Gradebuilders teamed up with Allis-Chalmers tractors are rated the top bulldozing team in the business.

• • •

It's an all weather — all year round team that turns low margin jobs into profitable ones — it's a versatile team that pays for itself on any job. Get the complete facts from your friendly Baker — Allis-Chalmers dealer today.

BAKER

SPRINGFIELD, ILLINOIS

Proof THAT DENVER TESTING PAYS CONTINUING DIVIDENDS

Cost of crushing was reduced when screening tests showed Denver-Dillon Vibrating Screen would effectively screen out 50% of crusher feed which was already sufficiently fine.

Different reagent combination—and stage addition of reagents throughout flotation circuit not only reduced reagent consumption and cost, but also improved net recovery.

Tests proved how Denver Selective Mineral Jig could recover another mineral from complex ore profitably.

Cost of grinding was reduced when tests showed that by floating a coarser size particle and regrinding the middling particles in Denver Steel Head Ball Mill, recovery was increased and tailing losses due to slimes were lowered substantially.

When mineral characteristics of mine-run ore changed, Denver Laboratory Tests were used to determine most efficient flowsheet.

Rosiclare Lead and Fluorspar Mining Company *Reports*

$20,000 SAVED IN ONE YEAR

HOW THIS OPERATOR PROVED

TESTING PAYS!

The Problem

The problem confronting the Rosiclare Lead and Fluorspar Mining Company of Rosiclare, Illinois, was *how to economically recover galena and lead carbonate from ore fractions too fine for treatment in the heavy media plant.*

Solution

Testing proved lead could be recovered by Denver Selective Mineral Jigs. Two Denver Mineral Jigs (sizes 12″x18″ Duplex and 16″x24″ Duplex) were recommended and installed.

Result

Cost of *entire installation* including labor, materials and accessory equipment such as *hydraulic classifiers, pumps, steel flooring, piping* and *all dewatering devices* was returned by *over 400% in only 11 months'* operation.

Rosiclare Lead Reports:

"—With the introduction of Denver Jigs we killed two birds with one stone—(1) we removed the lead prior to recovery of fine sized gravity spar concentrate thus eliminating lead as an undesirable impurity and (2) we recover the lead in a marketable form at low cost."

Complete Ore Testing Facilities

Deco's modern ore testing facilities, the knowledge and experience gained in making thousands of ore tests of more than 150 different commercial minerals and materials from all parts of the world are available to serve you on a non-profit basis.

Our Test Engineers are practical research men with years of testing experience. They are constantly in touch with leading mines, mills, universities, research bureaus, reagent manufacturers and designers of other mineral recovery equipment in order to make available to our friends the world's most economical and efficient methods of mineral recovery.

This vast experience accounts for our ability to quickly and economically arrive at practical solutions to tough treatment problems.

Your Cost for Denver Ore Test

As soon as we receive information about your ore and the tests required, our Test Engineers will furnish you a quotation based on the *actual cost-to-us* for making your tests. Then, if you desire, a sample of ore is submitted and your ore test is scheduled.

There is no obligation whatsoever when inquiring about cost of an ore test. Yet, results of competent testing can mean *improved recovery, lower tailing losses and reduced operating costs.* Write today.

DENVER EQUIPMENT 24 HOUR SERVICE COMPANY

"The firm that makes its friends happier, healthier, and wealthier"

FLOTATION ENGINEERS

DENVER • NEW YORK CITY • CHICAGO
EL PASO • TORONTO • MEXICO, D. F.
LONDON • JOHANNESBURG • RICHMOND, AUST.

DENVER EQUIPMENT COMPANY
1402 Seventeenth St., Denver 17, Colorado

Please send me complete information on Denver Ore Test of _____ (material)

Name _____

Title _____

Company _____

Address _____

Blast for This Road Without Damaging the House?

They Did It!

By Controlling Throw With the

ROCKMASTER "16" Blasting System!

How's this for a tough blasting assignment? The A. B. Long Construction Co., widening a highway through Hunter, Tennessee, was faced with the job of blasting away 14 feet of rock bluff only 47 feet from a home and directly under a main powerline. Rock had to be broken small enough for a ¾-yard shovel. Small blasts would cost too much in time and money. The shooting plan called for firing 174 holes at one time using 525 pounds of Atlas dynamite—depending on the Atlas ROCKMASTER "16" Blasting System to hold vibration and rock-throw to a minimum. Old hands at blasting said that the house was sure to be showered with rock fragments.

They were wrong! Once again, ROCKMASTER "16" did the "impossible"! Not a single rock touched the house or powerline . . . not a single window was even cracked! What is more, shovels moved right in after the blast: the finely broken rock, instead of being scattered all over the place, was in a neat pile almost exactly in its original position.

ROCKMASTER "16" can probably help solve *your* blasting problems—whether you blast rock, coal, or metal . . . on the surface or underground! Read how it's done in the new ROCKMASTER "16" booklet, which tells how this new blasting system, pioneered by Atlas, controls the timing between holes to thousandths of a second. Read how the proper choice of timing, loading, and explosives gives you far better control of breakage . . . saves drilling and dynamite . . . cuts down noise and vibration . . . controls throw as it never could be controlled before.

Write for your copy of the ROCKMASTER "16" booklet today and see for yourself how this latest Atlas development—featuring *sixteen* milli-second delay detonators—can help *you!*

ROCKMASTER "16" TIMINGS

Rockmaster No.	Avg. Time of Each Delay from Zero (milli-seconds)
0 (zero)	0 (inst.)
1	8
2	25
3	50
4	75
5	100
6	125
7	150
8	175
9	200
10	250
11	300
12	350
13	400
14	450
15	500
16	550

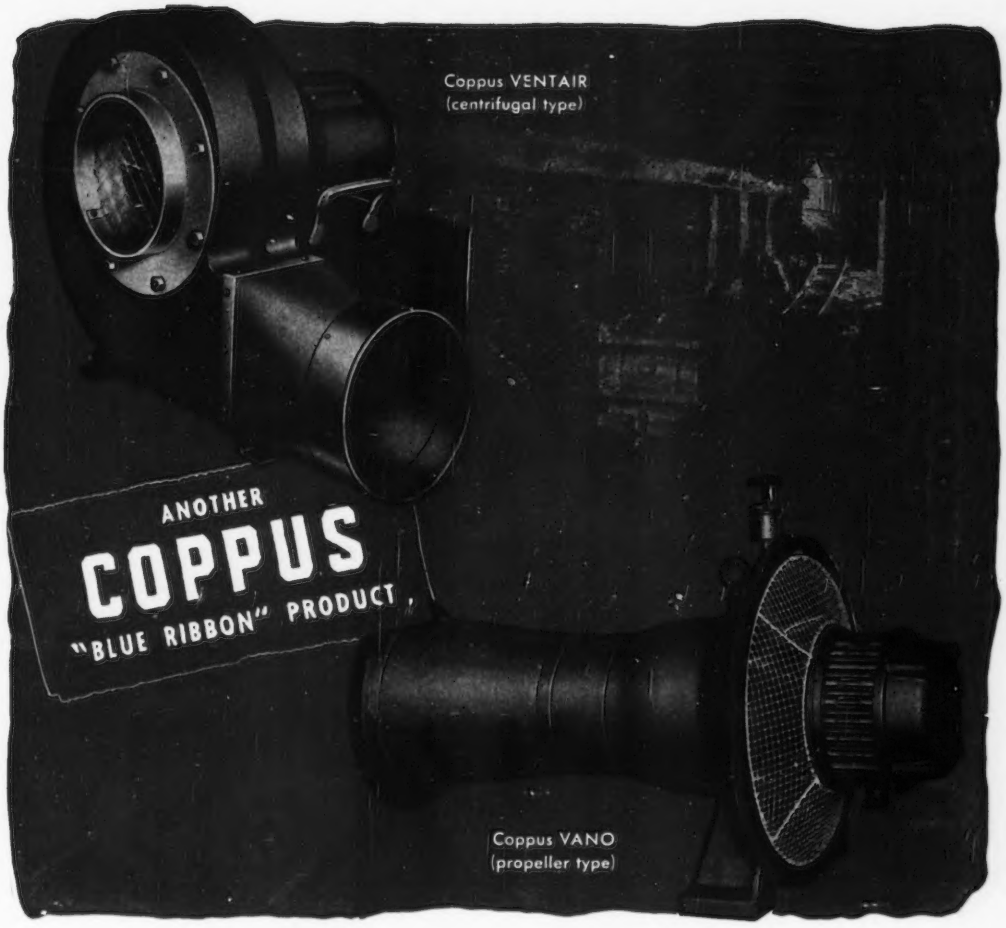
ROCKMASTER: Reg. U. S. Pat. Off.

ATLAS EXPLOSIVES

"Everything for Blasting"

CHEMICALS ATLAS EXPLOSIVES

ATLAS POWDER COMPANY, Wilmington 99, Del. • *Offices in principal cities* • *Cable Address—Atpowco*



Two Blowers . . . One Purpose:
30 to 100% More Air

Why two totally different blower types? Because the requirements of mine ventilation fall into two entirely different categories.

For high pressures, long pipe lines, use the Coppus VENTAIR (centrifugal type). For medium pressures, shorter pipe lines, the Coppus VANO (propeller type) is best. One or the other will give you more air per given power consumption than other blowers — from 30% to 100% more. Can be used as blowers or exhausters, capacities up to 90,000 CFM, with compressed air or electric motor drive.

Only Coppus makes both types. And, for quick recognition, each wears the famous "Blue Ribbon," distinguishing mark of top-quality engineering, materials and performance. This blue band is your guarantee of better mine ventilation . . . Look for it.

***Representatives listed in MINING CATALOGS.** Other Coppus "Blue Ribbon" products: steam turbines, gas burners, heat killers, air filters, blowers and exhausters for special purposes. See also THOMAS' REGISTER . . . Coppus Engineering Corporation, 282 Park Ave., Worcester 2, Mass.*

COPPUS ENGINEERING CORPORATION
291 Park Avenue, Worcester 2, Mass.

Please send: Bulletin 130.

Name.....

Company .....

Address.....

55 HORSEPOWER

Runs 2 Kue-Ken Crushers*

Produces 40 tons per hour of hard rock to minus ¾". *Only* 55 H. P. runs both crushers!

On the installation shown in picture (firm name on request) a No. 70 Kue-Ken Simplex Jaw Crusher with 30" x 15" opening receives truck loads of extremely hard granite boulders. These are crushed to minus 2½ inches. Crusher discharges onto vibrating screen with ¾" openings. Minus ¾" screen product bypasses 18" Kue-Ken gyratory and goes direct to stock pile.

Plus ¾" rock from screen is delivered to Kue-Ken gyratory crusher without a feeder. Gyratory crusher converts rock to minus ¾".

This customer expresses gratification at the low power consumption, as the firm generates its own power and all fuel must be hauled 8 to 10 miles. They also report a full year's operation without a single replacement of jaw plates or any other part.

KUE-KEN GYRATORY

Operates on the long-proved Kue-Ken principle of "crushing without rubbing." Powerful, compact, yet with larger, stronger shafts—7" dia. in 18-inch crusher, which provides greater bearing area for cool-running, longer life. LOW HEADROOM—18-inch crusher only 30¼" high, TAKES CHOKED FEED of hardest rock—no feeders required. Other exclusive Kue-Ken features described at left. Sizes, 18" and 3 ft. at present time.

KUE-KEN JAW CRUSHER

Pictured is No. 70, 30" x 15". Perfect lubrication on all mechanism in oil-tight housing stops wear, requires attention only twice a year. Automatic features give complete protection against lubrication failure and over-loading. A miser for power, a giant for production. All-steel frame is three times stronger than cast iron, weighs only half as much. Can be choke-fed—flood it with rocks and keep it full. Other sizes from 12" x 7" to 42" x 25".

*Pronounced Que-Ken. U. S. and Foreign Patents Pending.

These Features SAVE You Money

LONGER LIFE. Kue-Ken jaw plates wear 5 to 10 times longer because fast-wearing rubbing and abrasive action is eliminated. Saves costly replacements.

LIGHTER WEIGHT, HIGHER SPEED. Exclusive Kue-Ken design permits 30-40% saving in crusher weight, 50-60% higher crushing speed. Kue-Ken Crushers have greater capacity, turn out bigger volume and more uniform product with less power.

OVERHEATING ELIMINATED. Larger, heavier, stronger shafts with greater bearing surface reduces bearing pressure and wear. Bearings are sealed in filtered oil and pump-lubricated. Result: Complete protection from dirt and abrasive, a crusher with long life at full-speed production.

AUTOMATIC PROTECTION. Kue-Ken Crushers are equipped with built-in automatic release, insurance against expensive shut-downs due to tramp iron or overloading. An automatic cut-off is also provided, which stops crusher instantly in case of lubrication failure.

MORE PRODUCTION WITH LESS POWER. Kue-Ken Crushers using the exclusive Kue-Ken principle of "crushing without rubbing" give 2 to 3 times greater capacity than old-style crushers with less horsepower, substantially reducing operating cost.

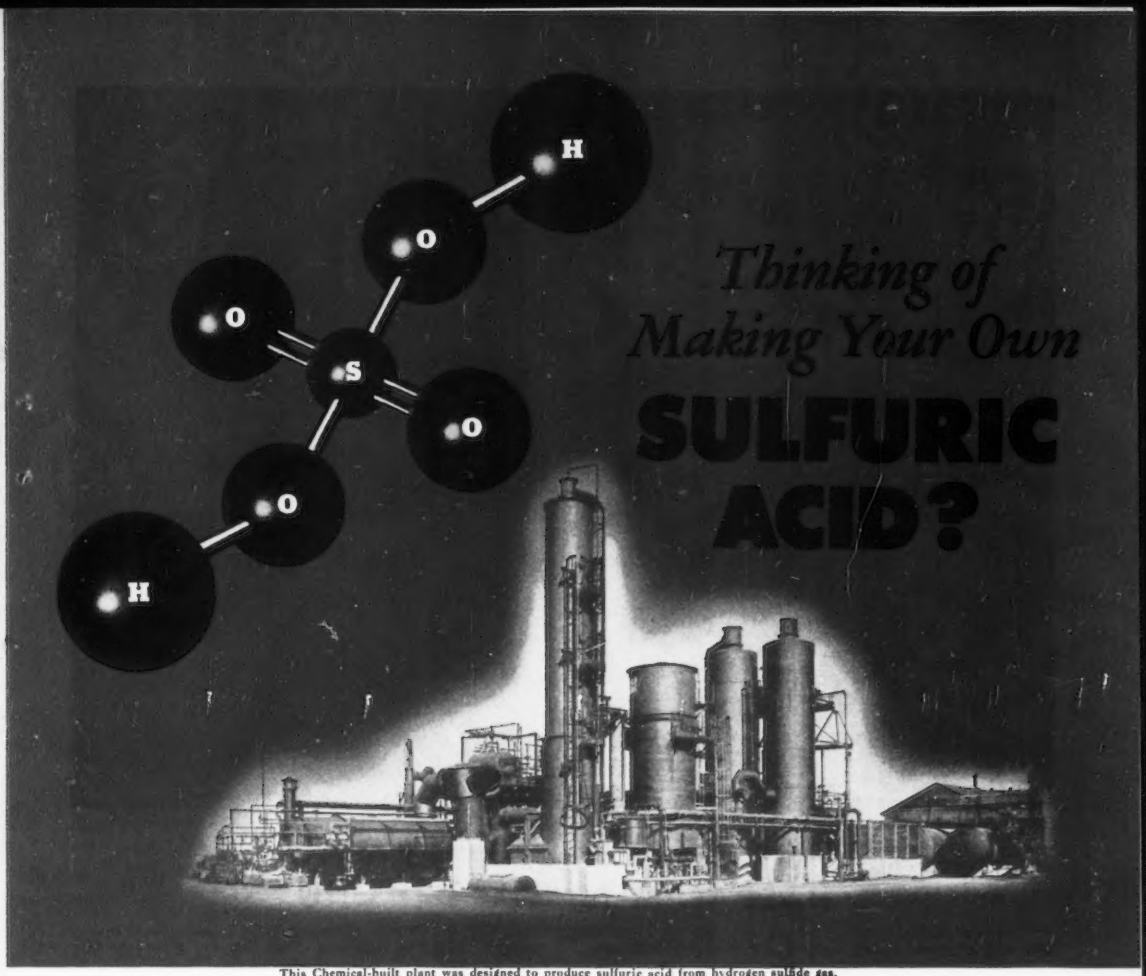
GET THE FACTS. Write today for Gyratory Bulletin 604 or Jaw Crusher Bulletin 605.

Exclusive manufacturer for Eastern U.S., Canada and Puerto Rico: Pennsylvania Crusher Co., Broad and Arch Sts., Phila., Pa.

520 Chestnut St. **Oakland 20, California**

STRAUB MFG. CO.

Kue-Ken Balanced Crushers	Rib Cone Ball Mills	Overflow Classifiers
Kue-Ken Simplex Crushers	Concentrating Tables	Feeders
Kue-Ken Gyratory Crushers	Overhead Eccentric Crushers	Screenwheel Classifiers



This Chemical-built plant was designed to produce sulfuric acid from hydrogen sulfide gas.

Many users find it economical to buy sulfuric acid in drums or in tank cars. Others—who need larger quantities—produce their own more profitably. If you have been contemplating the expansion of your present facilities or the erection of a new plant for the manufacture of sulfuric acid, consider these facts about Chemico-built contact acid plants.

TROUBLE FREE OPERATION—You get maximum production of acid the year round because of Chemico's *exclusive* Spray Type Sulfur Burning Equipment.

ECONOMICAL HEAT RECOVERY—Heat resulting from the combustion of sulfur and from the conversion of SO_2 to SO_3 is recovered in waste heat boilers and economizers as valuable by-product steam. This makes possible greater economy of operation, elimination of the need for a separate supply of steam and cools the gases to suitable operating temperatures.

HIGH CONVERSION—The high production rate and low operating costs of Chemico plants are largely due to the well-designed converters and the use of the highly effective, non-poisonable Vanadium Catalyst.

These cost-reducing design features are only a few of the outstanding benefits of Chemico-built sulfuric acid plants. They may point the way to vital savings in fulfilling your acid needs. But before deciding whether it would be sound business to produce your own sulfuric acid, discuss your specific problems with Chemico.

AN INTERESTING BULLETIN S-101—gives you additional information on Chemico Sulfuric Acid Plants. Write for your copy today.

CHEMICAL CONSTRUCTION CORPORATION

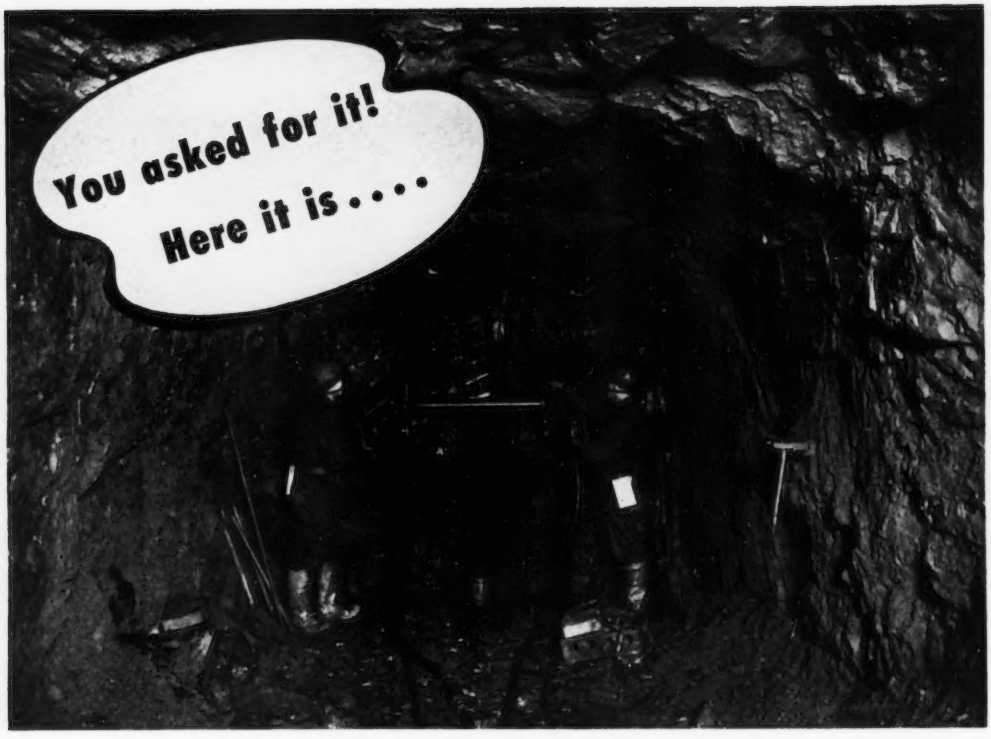
EMPIRE STATE BLDG., 350 FIFTH AVENUE, NEW YORK 1, N. Y.

EUROPEAN TECHNICAL REPRESENTATIVE
CYANAMID PRODUCTS, LTD., BRETTENHAM HOUSE, LANCASTER PLACE, LONDON W. C. 2, ENGLAND
CABLES: CHEMICONST, NEW YORK

CHEMICO
CHEMICAL CONSTRUCTION CORP.

Chemico Plants are Profitable Investments

CC-191



New *Homo-Flex* Heavy-Duty HOSE TEAM for WET DRILLING

Men who mine and quarry and excavate with wet drills have long demanded air and water hose that will withstand the scuffing and crushing of falling rock and rough working conditions. Manhattan engineers applied the Homo-Flex principle of hose construction to its hardest test . . . and today you have your answer . . .

THE ROUGH, TOUGH TEAM OF *Condor* HOMO-FLEX HEAVY-DUTY AIR HOSE and HEAVY-DUTY WATER HOSE

Both of these rugged hose constructions feature extra thick cover protection that is literally "rubber armorplate". Every abusive blow rebounds from these new Homo-Flex constructions where lesser hose would be seriously gouged and injured.

Sharp bends over and around machines and rock are taken in stride by this tough team. Their sinewy hose walls stand up without kinking or collapsing. Thus, you can always be sure of a full feed of air and water to your wet drills.

Only Manhattan's exclusive principle of Homo-Flex construction makes possible this superior air and water hose team with their heavy-duty stamina to take this punishing service and still be flexible and easy to handle. In Homo-Flex, Manhattan engineers have developed a method of fusing tube, strength member and cover into one inseparable unit – for extra long life, extra margin of strength and safety, extra flexibility – extra value all around.

Don't overlook this opportunity to equip your wet drills with Condor Homo-Flex Heavy-Duty Air Hose and Heavy-Duty Water Hose–It's the team you asked for–developed specifically for your problems.

The Air Hose type with its oil-proof tube is also unmatched in performance in other heavy-duty mining, quarry, and construction operations.

Keep Ahead with Manhattan

MANHATTAN RUBBER DIVISION – PASSAIC, NEW JERSEY

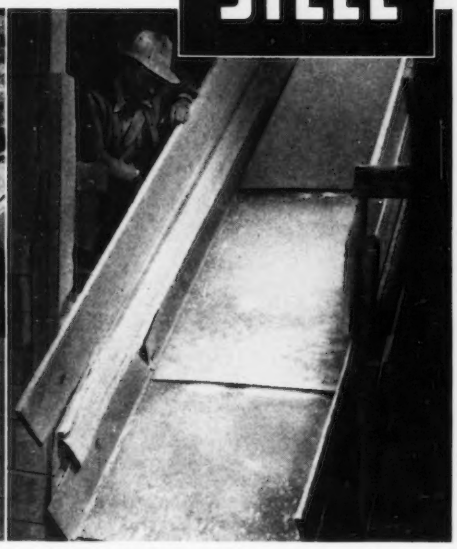
RAYBESTOS-MANHATTAN, INC.

Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment • Radiator Hose • Fan Belts • Brake Linings • Brake Blocks • Clutch Facings • Packings • Asbestos Textiles • Powdered Metal Products • Abrasive & Diamond Wheels • Bowling Balls

CHUTE COSTS CUT 66%
AT STUART M. PERRY COMPANY
WITH J&L JALLOY HEAT-TREATED STEEL PLATES

J&L STEEL

In Perry's primary crusher J&L *heat-treated JALLOY plates lasted ten times longer than mild steel under a daily pounding by 700 to 800 tons of blue limestone.*



Shaker tailing chutes receive severe sliding abration. $\frac{3}{16}$" J&L *plates lasted 22 weeks in this application—7 times service life of mild steel.*

Lower Maintenance . . . Longer Service Life Result in the exclusive use of J&L JALLOY on all chutes at stone crushing plant.

The Stuart M. Perry Company, quarrymen, of Winchester, Va., has turned to J&L JALLOY heat-treated steel to provide more efficient chute liners. Perry found that JALLOY plates last four to twenty times longer than mild steel.

The result—"JALLOY steel has cut my chute costs by two thirds." That's what Thurman Perry, supervisor of the Stuart M. Perry Company, had to say about the JALLOY steel he ordered from William G. Wetherall, Inc., Baltimore, Md.

But more specifically here's how J&L JALLOY reduced Perry's maintenance costs:

• Used as a grisley plate in the primary crusher—JALLOY lasted 5 months—10 times longer than mild steel—Saved 44 man hours per JALLOY installation.

• As the bottom chute in a 3 ft. Symons Cone Crusher—JALLOY was still in operation after 16½ months—four times the life of mild steel.

• As the head chute from the bucket elevator—JALLOY lasted 16 months—20 times the life of mild steel—Saved 80 man hours labor.

• As a shaker tailing chute—JALLOY lasted 5 months—7 times longer than mild steel—Saved 72 man hours labor.

J&L heat-treated JALLOY, a fine grained, manganese-moly steel, has a yield strength of 160,000 lbs. per sq. inch and a Brinell hardness of 341 to 388. It is available in the form of bars and in plates up to 72" wide and 20' long, with thicknesses from $\frac{3}{16}$" to $1\frac{1}{2}$".

Although twice the price of mild steel, JALLOY'S long life saves money in applications where impact and abrasion are severe such as: conveyors, crushers, scrapers, bulldozers, power shovel buckets, dump cars, and heavy-duty truck bodies.

Write for the booklet "JALLOY—J&L Alloy Steel." It contains information on properties, heat-treating, and the workability of this *modern* steel. The coupon is for your convenience.

Jones & Laughlin Steel Corporation
412 Jones & Laughlin Building
Pittsburgh 19, Pa.

Please send me your data booklet:
"JALLOY—J&L Alloy Steel."

NAME_____

COMPANY_____

ADDRESS_____

Do you recommend J&L JALLOY Steel for:_____

JONES & LAUGHLIN STEEL CORPORATION

From its own raw materials, J&L *manufactures a full line of carbon steel products, as well as certain products in* OTISCOLOY *and* JALLOY (*hi-tensile steels*).

PRINCIPAL PRODUCTS: HOT ROLLED AND COLD FINISHED BARS AND SHAPES • STRUCTURAL SHAPES • HOT AND COLD ROLLED STRIP AND SHEETS • TUBULAR, WIRE AND TIN MILL PRODUCTS • "PRECISIONBILT" WIRE ROPE • COAL CHEMICALS

Bear Brand Xanthates

Z-3 POTASSIUM ETHYL

Z-4 SODIUM ETHYL

Z-5 POTASSIUM AMYL

Z-6 POTASSIUM PENTASOL AMYL

Z-8 POTASSIUM SEC. BUTYL

Z-9 POTASSIUM ISOPROPYL

This series of fine collectors is continually being developed and expanded to meet the problems of ore concentration throughout the world. We invite your inquiries concerning flotation concentration.

GREAT WESTERN DIVISION

THE DOW CHEMICAL COMPANY

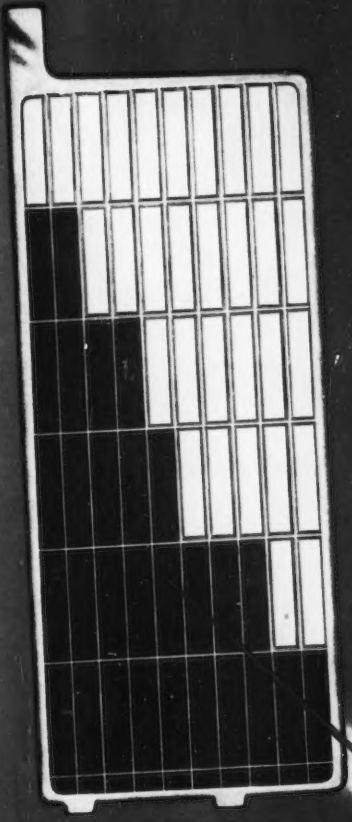
SAN FRANCISCO 4, CALIFORNIA, U. S. A.

PIONEER PRODUCERS OF XANTHATES FOR METALLURGICAL USE

NEW

GOULD "Z" Plate

THE ONLY PLATE WITH OXIDE THAT RENEWS ITSELF!



Only Gould gives you a power-producing regenerative oxide that renews its energy every day the battery is in use.

And—Only Gould's revolutionary, new "Z" grids are non-porous and solid all the way through.

The "Z" plate is the result of new techniques developed and perfected in the Gould Research Laboratory and proved in Gould's own pilot plant.

These exclusive Gould developments are why Gould batteries serve extra long more miles . . . operate at full capacity more months . . . give more for your battery dollar than ever before.

Ask for literature on how Gould's new research development makes Gould Batteries Stay New, Longer.

The Gould "Thirty"—America's Finest Motive Power Battery!

GOULD

STORAGE BATTERY CORPORATION

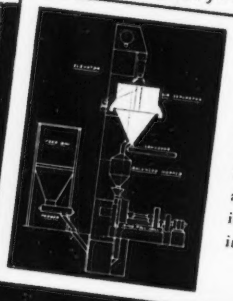
EDISON 2, NEW JERSEY

Always Use Gould Automobile and Truck Batteries

Here's How STURTEVANT Air Separators Increase Production of Fines... Lower Separation Costs

- Sturtevant Air Separators effect production savings by increasing output by 25 to 300% . . . reducing power consumption by as much as 50%.
- They efficiently carry off all classified materials in any desired fineness from 40 to 325 mesh and finer . . . eliminate the need of screening in certain applications.
- Capacities available from ¼ to 50 tons per hr.

Write for full details, today.



Sturtevant Air Separator in "closed circuit" with pulverizer. This combination increases tonnage and reduces costs in all types of industry.

Sturtevant Mill Company

101-A Clayton Street, Boston 22, Mass.

Designers and Manufacturers of: CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS • MECHANICAL DENS and EXCAVATORS • ELEVATORS • MIXERS

for continued operation at 75 C

...make sure it's Geoprene Portable Cable

Now you can cut cable size, stop hauling bulky 60 C cables. Tough General Electric Geoprene cables—rated in accordance with ASTM Specification D754-43T for 75 C operation—let you use lighter, smaller cables than ordinary rubber permits.

On many machines General Electric Geoprene-jacketed cables can produce substantial savings in cable size. Shovels, for example, that used to require a 4/0 Awg conductor, now need only a 2/0 Awg conductor in a Geoprene cable.

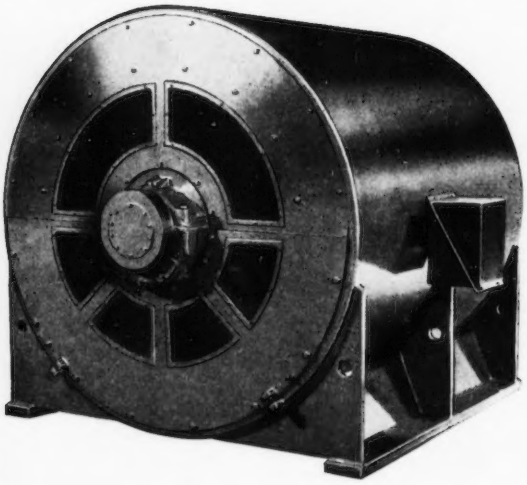
In addition to smaller size, Geoprene cables give you added toughness. With two and a half times the tear resistance of natural rubber, Geoprene can take the tough jobs in stride—make sizable savings in spots where replacements are normally high. Easy handling, flexible Geoprene cables are superior to rubber, too, in resistance to heat, sunlight, oils, alkalies, acid, and flame.

Why not get the whole story on what General Electric Geoprene cables can do for you? Call in your General Electric cable specialist, or write for the free bulletin, *Geoprene Portable Cable*. Address Section W57-1195, Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut.

G-E Geoprene-jacketed Portable Cables

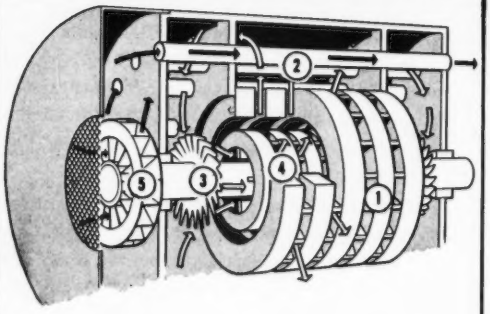
GENERAL ELECTRIC

TUBE-TYPE
TOTALLY-ENCLOSED FAN-COOLED MOTORS!



INSTALL INDOORS or OUT!

How Tube Cooling Works



Stator core (1) is surrounded by tubes (2). Internal fans (3) circulate air through ducts (4) in rotor and stator and around tubes, transferring heat to tubes. External fan (5) drives outside air through tubes, removing heat and keeping tubes clean. All electrical parts are enclosed. Dirt cannot enter.

- **Dirt-proof and corrosion-resistant**
- **Heat exchanger is practically *self-cleaning***
- **Simple self-contained cooling system—sizes from 75 to several thousand horsepower**

WHEREVER DUST, DIRT, fly ash, rain and snow, smoke, or corroding fumes keep motor maintenance costs high, this Allis-Chalmers tube-type motor will cut maintenance sharply.

All electrical parts—including stator core—are enclosed. Simple heat transfer system keeps temperatures well within rated limits. Cleaning is rarely needed because air passages are unrestricted. Air flow through the straight tubes removes foreign matter.

Important savings have been proved in three years of field operation. Sizes from 75 hp and up. Also explosion-proof designs. For complete information, outline your requirements to your A-C Sales Office, or write for Bulletins 05B7150 and 51R7149.

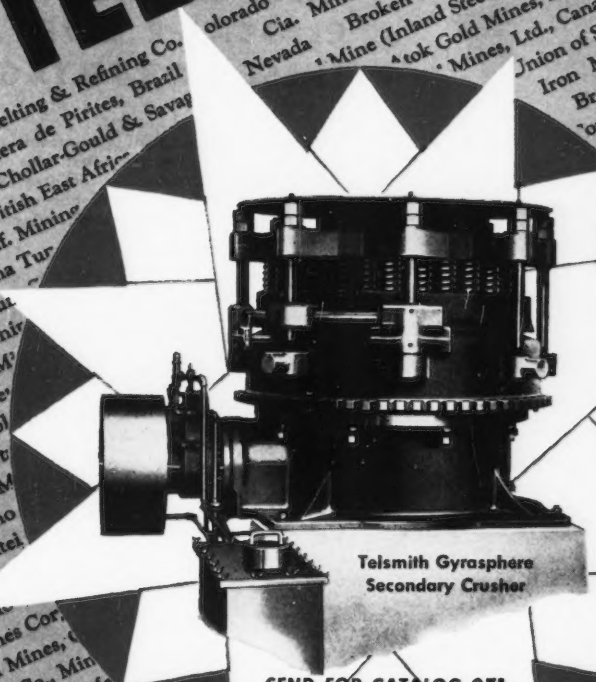
A-2610

ALLIS-CHALMERS, 969A SO. 70 ST.
MILWAUKEE. WIS.

ALLIS-CHALMERS

WHEREVER YOU GO...IT'S

TELSMITH



Telsmith Gyrasphere
Secondary Crusher

SEND FOR CATALOG 271

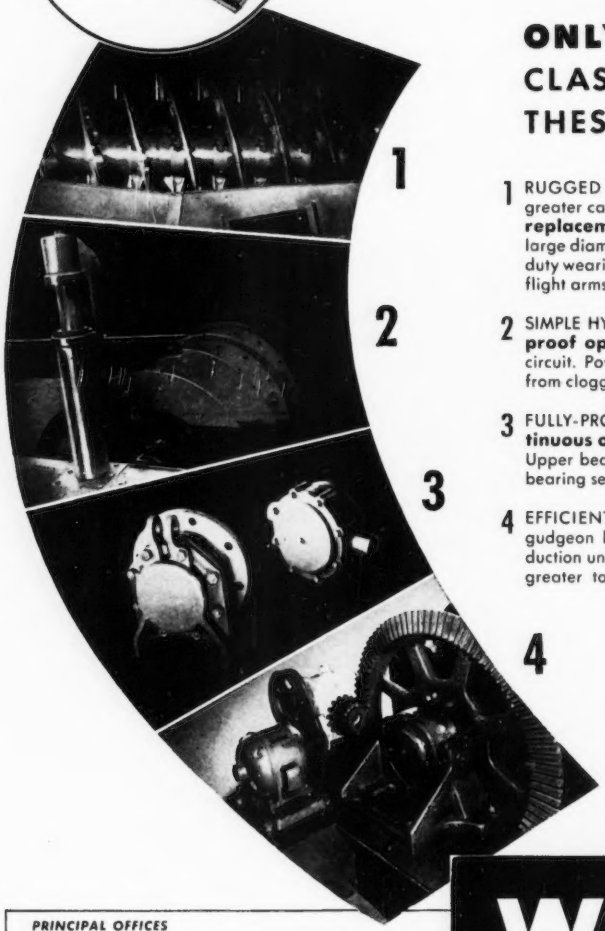
SMITH ENGINEERING WORKS, 502 EAST CAPITOL DRIVE, MILWAUKEE 12, WISCONSIN

Cable Address: Sengworks, Milwaukee

Samuel Osborn (S. A.) Ltd. Johannesburg, So. Africa
Armco International Corp. Buenos Aires, Argentina
51 East 42nd St. New York 17, N.Y.
211 W. Wacker Dr. Chicago 6, Ill.
Mine & Smelter Supply Co. Denver 17, Salt Lake City 11, El Paso
Mines Eng. & Equip. Co., San Francisco 4, Calif.
Mussens Canada Ltd. Toronto, Ont.—Montreal 3, P.Q.
Gordon Russell, Ltd., Vancouver, B. C.

MODERN DESIGN
makes the difference!

ONLY THE WEMCO S-H CLASSIFIER GIVES YOU THESE ADVANTAGES:



1 RUGGED SPIRAL ASSEMBLY to provide up to 100% greater capacity with minimum **lost time** and **lower replacement costs.** Exclusive advance pitch spiral, large diameter shaft—up to 40% stronger; thick, heavy duty wearing shoes; short, cast-steel, large cross-section flight arms.

2 SIMPLE HYDRAULIC LIFTING DEVICE for **easy, foolproof operation** by remote control in or about the circuit. Powerful, uniform action, complete protection from clogging or jamming.

3 FULLY-PROTECTED BEARINGS for dependable, **continuous operation.** Ball and roller type throughout. Upper bearing lubricated only **once a year.** Lower bearing sealed and grit proof.

4 EFFICIENT DRIVE with heavy duty main gears, simple gudgeon bearing mounting and cone-type gear reduction unit. **Compact, easy to maintain,** permits greater tonnage with **one size smaller motor.**

Only WEMCO gives you these outstanding mechanical advantages—the result of progressive, modern design which makes WEMCO "Best in Classifiers."

WEMCO
WESTERN MACHINERY COMPANY
760-766 FOLSOM STREET · SAN FRANCISCO 7, CALIFORNIA

WKE (HMS) Mobil-Mill • Coal Spiral • Standard Thickeners (HMS) Thickeners • (HMS) Media Pumps • Hydroseparators (HMS) Densifiers • (HMS) Separatory Cones • "SH" Classifiers Sand Pumps • Conditioner and Agitators • Fagergren Flotation Machines • Dewatering Spirals • (HMS) Laboratory Units

PRINCIPAL OFFICES

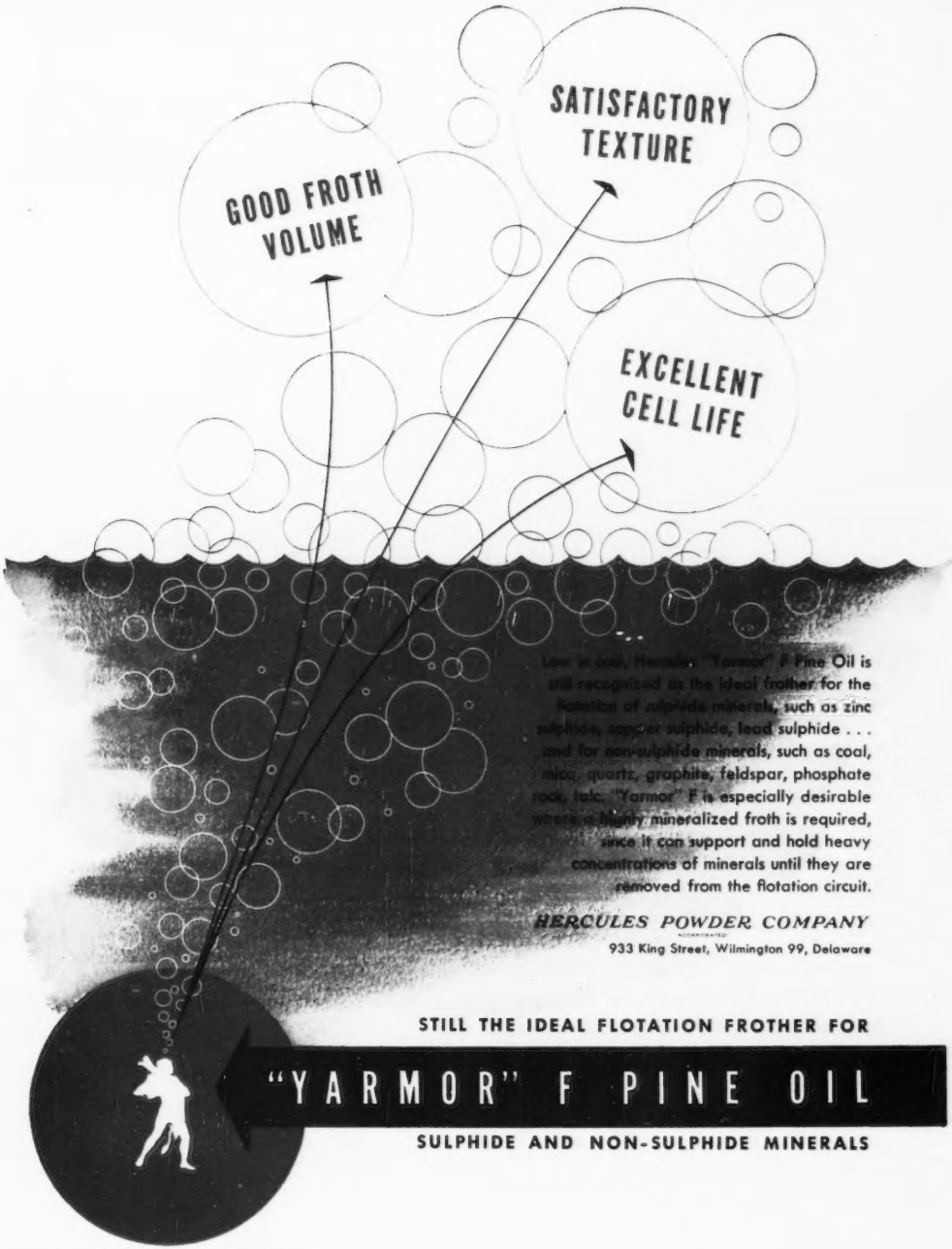
Los Angeles • Sacramento • Salt Lake City • Spokane
Pocatello, Idaho • Denver • Phoenix • Chicago
Hibbing, Minnesota • Bartow, Florida • New York

EXPORT DISTRIBUTORS

The Ore and Chemical Corporation
80 Broad Street • New York 4, N. Y.

Continental Europe and North Africa

Dr. Ing. Herbert Lickfett A/B, Stockholm 3, Sweden
Milieu Dense, Paris, France
Ferdinand Egeberg & Company, Oslo, Norway
Macchine ed Impianti Ing. Donati & Co., Milan, Italy
A. Schubarth & Company, Basle, Switzerland
G. Maltsiniotis & Co., Athens, Greece
Agence Miniere & Maritime, S. A. Antwerp, Belgium
Adil Gabay & Albert Koenka, Istanbul, Turkey



Low in cost, Hercules "Yarmor" F Pine Oil is still recognized as the ideal frother for the flotation of sulphide minerals, such as zinc sulphide, copper sulphide, lead sulphide . . . and for non-sulphide minerals, such as coal, mica, quartz, graphite, feldspar, phosphate rock, talc. "Yarmor" F is especially desirable where a heavily mineralized froth is required, since it can support and hold heavy concentrations of minerals until they are removed from the flotation circuit.

HERCULES POWDER COMPANY
INCORPORATED
933 King Street, Wilmington 99, Delaware

STILL THE IDEAL FLOTATION FROTHER FOR

"YARMOR" F PINE OIL

SULPHIDE AND NON-SULPHIDE MINERALS

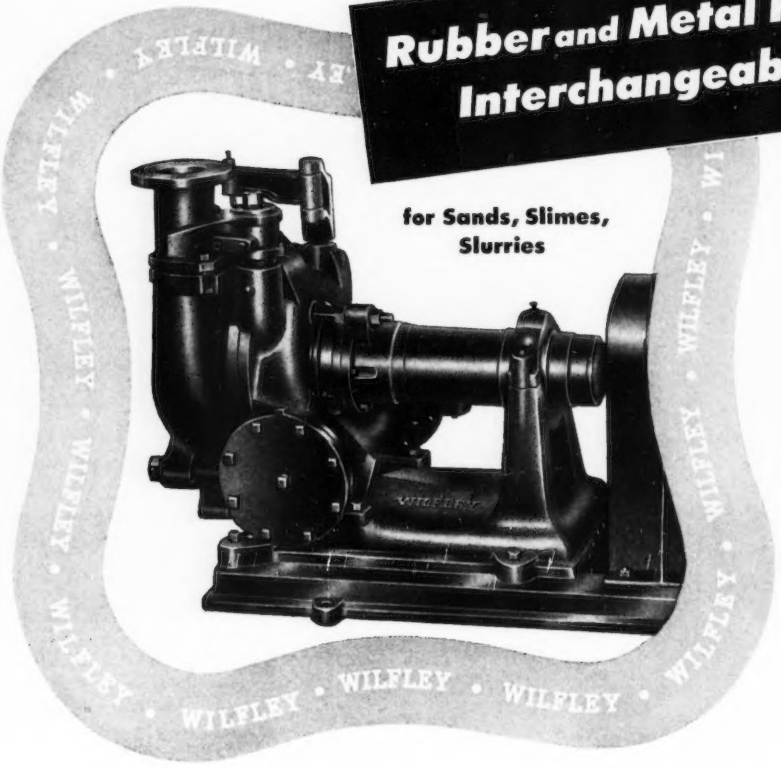
HAVE YOU TRIED THIS NEW COLLECTOR?

Hercules Rosin Amine D provides a relatively new cationic flotation reagent—an excellent collector for silica and siliceous minerals. It can be used to beneficiate many non-metallic and oxide ores, such as feldspar, phosphate rock, cement rock, and iron ore. Write for details.

"YARMOR" IS REG. U. S. PAT. OFF. NM9-1

Rubber and Metal Parts Interchangeable

for Sands, Slimes, Slurries



A Companion to the Famous WILFLEY Acid Pump

•

Buy WILFLEY for Cost-Saving Performance

Complete interchangeability of parts— rubber to metal, or metal to rubber— is one of many outstanding improvements that make the WILFLEY Sand Pump a big factor in cost-saving production. Stepped-up production, greater efficiency and worthwhile power savings ALL result from WILFLEY'S proven dependability and exclusive construction features. In addition to rubber, wear parts are available in electric furnace iron and other materials individually engineered for every application. An economical size for every purpose. Write or wire for complete details.

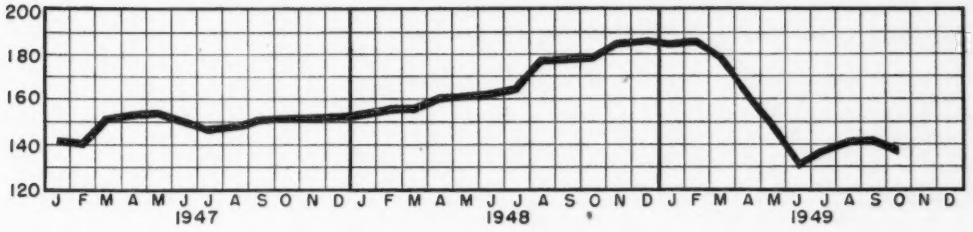
WILFLEY
centrifugal **PUMPS**

A. R. WILFLEY & SONS, INC.
DENVER, COLORADO, U.S.A.
New York Office: 1775 Broadway, New York City

E&MJ OUTLOOK

E&MJ Weighted Index of Non-Ferrous Metal Prices

(100 is composite for 1922-3-4 of Copper, Lead, Zinc, Tin, Silver, Nickel, Aluminum prices.)



●

MARKETS

Steel and coal strikes, and a precarious foreign exchange market were ignored in Wall Street, but hurt non-ferrous metal prices. Monthly averages for lead, zinc and tin dropped. Net result — E&MJ price index fell to 137.81 in October from September's 142.24.

Zinc slid to 9¼c. but climbed back to 9¾c. Copper remained at 17⅝c. although the large sales volume warranted a jump to 18c. or even 18½c. Lead imports continued to squeeze domestic producers.

●

LABOR

Galvanizers who should know were buying zinc as October ended. Murray was closing deals with several smaller producers. It added up to early settlement of the steel strike — perhaps before you read this.

IUMMSW is losing ground. Its strike settlement at American Metals' Carteret copper refinery was based on company offers made two months ago. And run-ins with CIO have left it weaker. This winter the stage is set for Steelworker, or other CIO, raids which will harass metal mining.

●

AT HOME

The 81st Congress did nothing about percentage depletion for non-metallic mines. Action awaits a House investigation next year, of the whole question of percentage depletion.

Talk of raising the price of gold is no more than that. Just talk!

The O'Mahoney Bill (S. 2105) lost out this session (See p. 108,) but it will be on Congress's doorstep next January. You can also look for real drive behind tax reform proposals for mining.

●

ABROAD

A last-minute Senate-House compromise restored the Munitions Board's long term contract authority ($420 million worth) for buying minerals. State Department is urging foreign purchases of non-ferrous metals for stockpiles, as good global strategy. In Yugoslavia, for instance, dollar exchange could widen the Stalin-Tito breach. But foreign buying would further weaken the market for U.S. producers.

Chilean Development Corp. will get $2,750,000 credit from the Export-Import Bank. The loan will aid development of El Romeral iron mine, a Bethlehem Steel Corp. subsidiary.

The plan to supply India with a million tons of wheat in return for long term payments in mica and manganese, is too unrealistic for important consideration. Wheat would be spread too thin to do much good and U.S. would monopolize 3 or 4 years of record Indian output as payment.

Foreign investors may be approached by New Zealand if sufficient capital cannot be raised locally to develop two important new lead properties.

MARKETS—Trends and Prices

Copper Shipments Rise—Lead and Zinc Unsettled—Tin Trading on London Metal Exchange to Resume

AS OCTOBER ENDED there was hope that the work stoppage in the steel industry was nearing its end, which caused operators in ores, metals and minerals that suffered because of the strike to take an optimistic view of the immediate outlook.

Steel production in the fourth week of the strike was estimated at 9% of capacity, equivalent to only 166,000 tons of ingots and castings. This compares with an operating rate of 84.6% of capacity in the last week of September, equivalent to 1,559,600 tons of ingots and castings.

The aluminum industry was confronted with difficulties growing out of an unexpected cut in output that resulted from a strike at nine plants of the Aluminum Company of America. About 50% of the company's production was shut down on Oct. 17 when CIO Steelworkers struck, largely because of pension demands. Production of primary aluminum in the United States in the Jan.-Aug. period totaled 430,908 tons, an average of 53,863 tons a month. Stocks of aluminum in the hands of producers increased from 11,746 tons at the end of April to 48,411 tons at the end of August.

A compromise on stockpile funds fixed the sum available to the Munitions Board for contract purchases in the current fiscal year at $420,000,000. The House had asked for $520,000,000, but the Senate reduced this to $275,000,000. The compromise figure, in addition to $565,000,000 in cash already voted for outright purchases, points to continued heavy stockpiling of strategic materials. Copper, lead and tin are expected to benefit most in the field of non-ferrous metals. Stockpiling authorities already are interested in purchasing copper for delivery in the Jan.-June period of 1950.

Dollar Crisis Continues

Devaluation of the pound and other foreign currency problems growing out of the dollar shortage continued as unsettling factors in international trade. Unwillingness on the part of some producers to accept anything but dollars in payment for raw materials has resulted in increased offerings of lead in the United States market from various foreign sources. This pressure was less pronounced in copper owing largely to the heavy demands for the metal in this country. Zinc suffered a little because of a decline in export orders.

Except for a reduction in the price of tin by RFC to the level fixed by the British, that commodity passed through a rather quiet period. A temporary sharp drop in tinplate production, owing to the steel strike, naturally cut deeply into consumption. Of particular interest to the tin trade was the statement in the House of Commons by Minister of Supply Strauss to the effect that "free" dealings in tin will be permitted after Nov. 15. He also revealed that the British will abandon their wartime policy of bulk buying and selling of tin. The London Metal Exchange is to reopen, but it will have to limit its transactions to tin. Trading in copper, lead and zinc would not be permitted, obviously because of possible foreign exchange complications. Whether tin can be traded in as a truly free commodity under prevailing upset economic conditions was questioned in local tin circles. Stockpile buying may enter into the picture, along with production controls and other support schemes. The decline in the price that was announced soon after devaluation of the pound became effective has brought in its wake appeals for aid from high cost producers of tin in Bolivia and elsewhere.

With the supply of tin in excess of requirements, domestic consumers hold that a free market will bring about a lower price level.

Copper Shipments Large

The copper industry paid little or no attention to unfavorable strike news and the falling rate of general business activity growing out of the stoppages in the steel and coal industries. In fact, the demand for copper continued at a high rate and the market here has moved into a strong position. Labor difficulties kept the price from rising, most observers agreed. Sales booked in the domestic market during October approached the 100,000-ton mark and deliveries for the month are expected to exceed this figure.

Consumption of copper in the United States in September, the latest month for which statistics are available, was estimated at 114,760 tons. This is the quantity contained in products shipped to consumers by the fabricating division of the industry. The September total is the highest so far this year.

Monthly shipments of copper contained in products delivered by fabricators to customers, in tons, for 1948 and the nine months of 1949, follow:

	1948	1949
January	127,227	109,551
February	115,238	93,474
March	120,167	89,834
April	117,331	65,461
May	112,730	61,383
June	120,172	71,124
July	103,488	61,220
August	115,036	(a) 88,088
September	126,236	114,760
October	126,700	.....
November	108,266	.....
December	101,716	.....
Total	1,394,307	.....

(a) Revised

Production of crude copper in the United States in September amounted to 64,237 tons, of which 56,946 was primary and the remainder secondary. Output of crude outside of the United States in September totaled 100,520 tons.

On Oct. 28 it was announced that the strike at the Carteret refinery of the American Metal Co. was settled. Resumption of operations at the copper refinery, closed since early July, will relieve the market of the existing shortage in various shapes.

Consumers of lead purchased the metal as needed. The supply situation favored the buyer. Offerings of lead from abroad persisted and domestic sellers were quick about meeting price competition. The price scored a net loss

Average Prices for October (E&MJ Quotations)

Copper:	
Electrolytic, Domestic, Refinery	17.325
Electrolytic, Export, Refinery	17.550
Lead:	
Common, New York	13.420
Common, St. Louis	13.230
Silver and Sterling Exchange:	
Silver, New York, per oz.	73.250
Silver, London, pence per oz.	63.887
Sterling Exchange, "Checks"	279.600
Zinc:	
Prime Western, East St. Louis	9.320
Tin:	
New York, Straits	95.720
New York, 99% min.	(e) 94.720
Gold, per oz. U.S. price	$35.000
Quicksilver, per flask	$73.000
Antimony, (E&MJ) (d)	36.580
Antimony, bulk, Laredo	33.300
Antimony, in cases, Laredo	33.800
Platinum, Refined, per oz.	$69.000
Cadmium (a)	200.000
Cadmium (b)	207.500
Cadmium (c)	215.000
Aluminum, 99% plus, ingot	17.000
Magnesium, ingot	20.500
Nickel (f)	40.000

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange, checks, in cents. Quicksilver, per flask of 76 lb.

(a) Cadmium average based on the producers' quotation.

(b) Cadmium average based on the average of the producers' and platers' quotation.

(c) Cadmium average based on platers' quotation.

(d) Domestic, 5 tons or more but less than carload lot, packed in cases, f.o.b. New York.

(e) Tin contained.

(f) F. o. b. Port Colborne, U. S. duty included.

of 1¾c. per pound, moving down to 13c., New York, on Oct. 14.

Imports of lead have been surprisingly large, in spite of the reimposition of the duty on July 1. Official figures for August showed imports of lead in ore, matte, etc., of 7,692 tons and imports of pig lead of 29,794 tons. Mexico supplied 12,537 tons of pig lead; Canada 4,540 tons; Peru 4,980 tons; Yugoslavia 3,242 tons; and Germany 3,395 tons.

Zinc presented a mixed picture. Work stoppages at New Jersey Zinc and Bunker Hill & Sullivan continued, reducing the available supply of Special High Grade used in die casting. Demand for this grade was active throughout the month. The American Smelting & Refining Co. announced that it has raised its differential on Special High Grade over Prime Western to 1¼c. per pound (delivered basis). Other producers are expected to follow sooner or later. In regard to Prime Western, the steel strike cut down consumption and caused the price to decline on Oct. 3 to 9¼c., East St. Louis. However, as optimism over the steel dispute mounted toward the end of the month the price advanced to 9½c.

Production of slab zinc in the United States totaled 70,302 tons in September, against 73,819 tons in August.

Quicksilver was unsettled on forward business but steady on spot at $73 per flask. Tungsten ore was firmer on reduced pressure from the Far East. Manganese ore was unsettled on reports of cheaper offerings from India.

(Continued on page 113)

Major Metals

U. S. DAILY AND AVERAGE PRICES

Oct. 1949	Electrolytic (a) Domestic	Copper (b) Export	Straits Tin New York	Lead New York	Lead St. Louis	Zinc East St. Louis
1	No Market	17.550	96.000	14.750	14.550	10.000
3	17.325	17.550	96.000	14.250	14.100	9.250
4	17.325	17.550	96.000	14.250	14.050	9.250
5	17.325	17.550	96.000	14.250	14.050	9.250
6	17.325	17.550	96.000	14.250	14.050	9.250
7	17.325	17.550	96.000	13.750	13.600	9.250
8	No Market	17.550	96.000	13.750	13.600	9.250
10	17.325	17.550	96.000	13.750	13.550	9.250
11	17.325	17.550	96.000	13.750	13.550	9.250
12	Holiday	17.550	Holiday	Holiday	Holiday	Holiday
13	17.325	17.550	96.000	13.750	13.550	9.250
14	17.325	17.550	96.000	13.000	12.850	9.250
15	No Market	17.550	96.000	13.000	12.850	9.250
17	17.325	17.550	96.000	13.000	12.800	9.250
18	17.325	17.550	96.000	13.000	12.800	9.250
19	17.325	17.550	96.000	13.000	12.800	9.250
20	17.325	17.550	96.000	13.000	12.800	9.250
21	17.325	17.550	96.000	13.000	12.800	9.250
22	No Market	17.550	96.000	13.000	12.800	9.250
24	17.325	17.550	95.000	13.000	12.800	9.250
25	17.325	17.550	95.000	13.000	12.800	9.250
26	17.325	17.550	95.000	13.000	12.800	9.250
27	17.325	17.550	95.000	13.000	12.800	9.500
28	17.325	17.550	95.000	13.000	12.800	9.500
29	No Market	17.550	95.000	13.000	12.800	9.500
31	17.325	17.550	95.000	13.000	12.800	9.500
AVERAGES FOR MONTH						
Oct.	17.325	17.550	95.720	13.420	13.230	9.320
AVERAGES FOR WEEK						
Oct.						
5	17.325	17.550	96.000	14.500	14.308	9.625
12	17.325	17.550	96.000	13.850	13.670	9.250
19	17.325	17.550	96.000	13.125	12.942	9.250
26	17.325	17.550	95.500	13.000	12.800	9.250
CALENDAR WEEK AVERAGES						
Oct.						
1	17.325	17.550	96.000	14.750	14.567	10.000
8	17.325	17.550	96.000	14.083	13.908	9.250
15	17.325	17.550	96.000	13.450	13.270	9.250
22	17.325	17.550	96.000	13.000	12.800	9.250
29	17.325	17.550	95.000	13.000	12.800	9.375

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Oct. 1949	Sterling Exchange "Checks"	Silver (c) New York	Silver (c) London	Gold London	Gold (d) United States
1	*(e)*	*(e)*	*(e)*	*(e)*	$35.00
3	279.500	73.250	63.250d.	248s.	35.00
4	279.500	73.250	63.250d.	248s.	35.00
5	279.500	73.250	63.500d.	248s.	35.00
6	279.500	73.250	63.750d.	248s.	35.00
7	279.500	73.250	63.875d.	248s.	35.00
8	*(e)*	*(e)*	*(e)*	*(e)*	35.00
10	279.500	73.250	64.000d.	248s.	35.00
11	279.500	73.250	64.000d.	248s.	35.00
12	Holiday	Holiday	64.000d.	248s.	Holiday
13	279.500	73.250	64.000d.	248s.	35.00
14	279.500	73.250	64.000d.	248s.	35.00
15	*(e)*	*(e)*	*(e)*	*(e)*	35.00
17	279.500	73.250	64.000d.	248s.	35.00
18	279.500	73.250	64.000d.	248s.	35.00
19	279.500	73.250	64.000d.	248s.	35.00
20	279.750	73.250	64.000d.	248s.	35.00
21	279.750	73.250	64.000d.	248s.	35.00
22	*(e)*	*(e)*	*(e)*	*(e)*	35.00
24	279.750	73.250	64.000d.	248s.	35.00
25	279.750	73.250	64.000d.	248s.	35.00
26	279.750	73.250	64.000d.	248s.	35.00
27	279.750	73.250	64.000d.	248s.	35.00
28	279.750	73.250	64.000d.	248s.	35.00
29	*(e)*	*(e)*	*(e)*	*(e)*	35.00
31	279.750	73.250	64.000d.	248s.	35.00
AVERAGES FOR MONTH					
Oct.	279.600	73.250	63.887d.	—	35.00
AVERAGES FOR WEEK					
Oct.					
5	279.500	73.250	—	—	
12	279.500	73.250	—	—	
19	279.500	73.250	—	—	
26	279.750	73.250	—	—	

Calendar week averages, New York Silver: Oct. 1st, 73.250; 8th, 73.250; 15th, 73.250; 22nd, 73.250; 29th, 73.250.

(e) No market (Saturday).

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.300c. per pound, the average differential for delivery charges.

(b) Our export quotation for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075c. for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c. to 0.15c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade and Special High Grade zinc delivered in the East and Middle West command a premium of 1c. per pound over the current market for the Prime Western.

Quotations for lead are for common lead. Corroding lead commands a premium of 10 points.

(c) The daily New York silver quotation reported by Handy & Harman is for silver contained in ores and other unrefined silver-bearing materials, in cents and one-eighth cent fractions per troy ounce. It is determined by Handy & Harman on the basis of actual sales of bar silver .999 fine in amounts of 50,000 ounces or more for nearby delivery at New York, and is usually one-quarter cent below the price paid for such bar silver, this deduction being the allowance for carrying, dilivering, and marketing. In addition to foreign silver, the quotations also apply to domestic and Treasury silver if such silver enters into the New York market.

The Treasury's purchase price of newly mined domestic silver 90.5c. per troy ounce 1000 fine, effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

Behind the By-Lines...

G. P. Lutjen

Keynoter for this issue is **Plato Malozemoff,** whose analysis of the rising costs of producing metals is found on page 72. Mr. Malozemoff acquired more than a nodding acquaintance with operating costs during the war when he was with the Mining Division of the OPA. His was the task of analyzing data sent in by mining companies in support of requests for assistance under the premium price plan. His excellent record for speed and accuracy in this difficult task won praise from all concerned.

He undertook the writing of this article under the impression that he was collaborating with **Bob Ramsey** of the E&MJ staff. As far as we can find out though, Mr. Ramsey's efforts were confined to shouting encouragement from the sidelines.

Among the important events in Colorado recently was the award of a citation for distinguished service and a medal to **E. D. Gardner,** Chief, Oil-Shale Mining Branch, U. S. Bureau of Mines. The presentation honors outstanding contributions of literature and public service to the mining industry during his 31 years with the Bureau of Mines. The award was made by Cap Krug during the banquet at Colorado Springs which concluded the first day of the oil-shale demonstration at Rifle. It was certainly an appropriate moment for the award as the experimental mine under Mr. Gardner's direction knocked its direct mining costs down to the amazing level of 26 to 28c. per ton.

Operation-Oil-Shale is a natural for a cost cutting issue and few people are better qualified to tell the story than Mr. Gardner. So you will find his report on that mining engineer's dream, complete with pictures, on page 92.

If Ralph Neyman, General Superintendent of Hecla Mining Co., ever claims squatter's rights to E&MJ pages, he'll get no argument from us. In the past his mechanical ability and talent for design produced such well received items as the "Shaft Jumbo" (E&MJ, April, 1947), "One Man Jumbo" (E&MJ, Nov., 1947), and "Roll-Over Dump Car" (E&MJ, Sept., 1948). This month we add to that worthy collection, his revelation of how they reduced drilling and blasting costs 30% at the Star mine (page 90). Need we say more?

In the mail this month was a fruitful letter from William A. Vickers of Wanakena, N. Y. He said in part:

"I noticed in your July issue (Special Issue) that there was nothing under the heading of 'Useful Operating Ideas,' which is the section that I get the most pleasure out of. So I am submitting a recently adopted idea that should be of interest."

Mr. Vickers' scheme (P. 114) not only affords a novel way of preventing concentrates from hanging up in a discharge chute, but offers an outlet for any old rubber girdles you may have around the house.

Eye-catching items in various departments are...a report on the Mining Congress meeting in Spokane (P. 111)...a review of the uranium situation at Sunshine (P. 131)...a "guillotine" for wire rope surgery in Equipment News (P. 126)...what goes on at Erie Mining Co.'s pilot taconite plant (P. 110).

It may interest you to know that General Motors' service engineers have now officially classified the noises made by a vehicle in distress. Those alarming sound coming from beneath the hood will hereafter be referred to as squeaks, rattles, thumps, grinds, knocks, scrapes or hisses. This standardization, it is claimed, is the first step toward understanding between driver and mechanic. That may be, but they won't solve our jalopy's problem until they add two divisions for wheezing and sneezing.

We'll let you draw your own conclusions, but our recent discovery in the Congressional Directory caused raised eyebrows in this quarter. In looking for an explanation of the mysterious symbols before the names of various congressmen, we found the following in fine print:

*"(The * designates those whose wives or husbands accompany them; the † designates those whose unmarried daughters in society accompany them; the ‖ designates those having other ladies with them.)"*

Anyhow, it sets an admirable example of frankness in these days of closed hearings and secret investigations.

Under the appropriate head, "Gilliam Finds Gallium", Natural Resources Notes declares that Gallium-bearing ore assaying as high as two lb. per ton has been reported by O. K. Gilliam, president of Rio Del Monte Mines in Yuma County, Arizona. This rare metal, the only one besides mercury to be liquid at near room temperatures, is under federal export prohibition. It was used by the Manhattan Project and brought $3 an ounce during the war.

This incident may or may not be significant, but we enjoyed the touch of irony. A gentleman of our acquaintance at one of the bigger lead companies, handling negotiations in which hundreds of tons of 15½-c. lead were involved, finally went off on a week-end fishing trip to relax. Darned if the first thing he had to do wasn't to pay 25c. for an eight-oz. sinker!

One of our editors, just back from Idaho, tells us that the Coeur d'Alene people refer to their new glamour ore as "Hooraynium."

ENGINEERING AND MINING JOURNAL

NOVEMBER, 1949

Metal Costs and Competition

WE'D LIKE TO DIRECT our readers' special attention to the article by Mr. Malozemoff that begins on page 72. He presents an analysis of the effect on the mining industry of the interplay of costs and prices that goes far beyond the immediate requirements of the balance sheet.

It is an article to be studied carefully, because its conclusions and its implications bear directly on the careers of every mining man. It is not an article to be accepted without question, because there is room for argument on many of the issues presented. We offer gladly the use of our columns for the furtherance of such discussion as the article may develop.

Mr. Malozemoff makes the point that it seems likely that production costs of metals can never be brought back to prewar levels simply because too many items of irreducible cost have been brought into play in the intervening years. Costs will be lowered only in some lesser measure, in certain ways pointed out in his article and in the other articles in this issue.

Therefore, it seems likely that metal prices will inevitably trend upward in the future, barring some sweeping technological advance in the art of mining or processing, or the discovery of some huge high-grade orebody.

The consumer, in turn, will have to resign himself to paying more in the future, rather than less, for those metals that have for so long been part of the basic fabric of this nation's heavy industry, if he wants to continue to use those metals.

Therein is the real point of the article, for it is, of course, inherent in the operation of free markets for commodities that a steadily rising price of a raw material will cause the consumers of it to look for substitutes.

This does not mean that the use of metals, considered as a whole, is destined to decline, but it does mean that over the next few generations there is bound to be a shift in emphasis among individual metals.

For example, the light metals, aluminum and magnesium, are steadily finding new points of usefulness. Over the horizon, titanium is looming as a competitor for many of the old-line metals. Other metals, as yet only laboratory curiosities, may some day be brought into full commercial usefulness by the shifting tides of competition.

This relationship of cost, price, and usefulness also means that every member of the working staff of a mining company has a direct stake in keeping the cost of his product, and therefore its price, as low as it is humanly possible. This is not a responsibility of management alone. To keep the metal he produces available to industry, and to insure the continuity and the future of his own job, each mining man shares in this over-riding responsibility, and shares to the fullest.

Handling the Subsidy Problem

BY A NARROW MARGIN, the O'Mahoney Bill (S. 2105), to provide exploration and conservation subsidies for mining, failed to win the approval of the House, and has therefore expired with the Eighty-First Congress.

If the Bill had become law, we intended to do what we could to help it work to the best interests of the mining industry and the country as a whole. We would have done this, even though we opposed passage of the Bill, because we hoped in some measure, thus to help guard against the serious dangers inherent in the administration of this subsidy, and in the disposition of the special stockpile of metals that the Bill would have established.

We would, for example, report fully, fairly, and accurately on developments as the system was set up, as contracts were let, and work began. If the public's funds are to be used to finance a mining operation, the public obviously has a right to know how the money is spent.

But although the Bill S. 2105 has failed of passage, we have no doubt that a similar bill will be introduced in the next Congress. If moderation prevails in writing and amending such a bill, it stands a very good chance of being enacted.

Therefore we should like to offer the suggestion that the vast majority of the mining industry make its wishes heard in the preparation of any new subsidy bill, as it has signally failed to do in connection with the O'Mahoney Bill. The Congressional Record shows plainly that neither in debate, nor in Committee hearings, was any widespread opposition to the Bill expressed. Yet we feel sure from our own conversations throughout the industry that the majority of mining men do not want a general subsidy, on these terms, applied to mining.

Now that there is time for all opinions to be heard, we look forward to an opportunity to help other industry spokesmen bring them to the attention of Congress.

TABLE I—How the Cost of Producing Copper Has Climbed

	1929[1] (000,000) lbs. Cu. Produced or Sold	1929 Cents per lb. Cu. Net[2] Oper. Costs	Tax and Int.	Total Costs	1939 (000,000) lbs. Cu. Produced or Sold	1939 Cents per lb. Cu. Net[2] Oper. Costs	Tax and Int.	Total Costs	1948 (000,000) lbs. Cu. Produced or Sold	1948 Cents per lb. Cu. Net[2] Oper. Costs	Tax and Int.	Total Costs
Andes	130.5	7.80	1.64	9.44	120.6	6.9	1.1	8.0	156.2	15.2	3.1	18.3
Chile	212.6	4.89	3.01	7.90	310.2	5.2	2.0	7.2	466.4	11.4	5.4	16.8
Inspiration	107.3	10.91	0.55[4]	11.46	51.6	11.4	0.5	11.9	76.7	14.1	2.3	16.4
Kennecott	1,066.0	7.45[3]	0.95	8.40	807.1	7.1[7]	1.0	8.1[7]	1,029.2	8.1[7]	5.1	13.2[7]
Phelps Dodge	151.2	11.78[5]	0.62	12.40	299.3	5.9[7]	1.0	6.9[7]	533.0	7.0[7]	5.5	12.5[7]
Miami	58.8	11.29	0.69	11.98	72.9	9.7	....	9.7	99.0[8]	16.46[6]	0.8	17.2[8]
Magma	38.2	8.64	1.65	10.66	34.6	7.5	0.4	7.9	37.8	18.1	0.8	18.9
Noranda	51.6	8.57	1.39	9.96	83.3	—1.85	1.86	0.0	43.7	5.3	4.6	9.9
Hudson Bay	....	....	....	....	56.9	0.2	1.6	1.80	79.8	—3.2	6.0	2.8
N. Rhodesian[8] Coppers	....	....	....	....	470.0	5.3	1.0	6.3	390.0	12.1	5.7	17.8

[1]Derived from Table 58 of U. S. Bureau of Mines Bull. 405, p. 275 (1938), which was reproduced from G. W. Tower "Cost of Producing Copper in the Americas," E&MJ, v. 130, 7/10/30, p. 25.

[2]After depreciation, precious and other metal credits, and miscellaneous income, but before depletion. Data derived from annual reports.

[3]Including Nevada Con. and Utah Copper; after depreciation and credits from revenues from RR, wharves, dividends and interest and estimated return from metal products, less Nevada Con. dividend paid to others in group.

[4]Includes administration.

[5]Includes precious metals in custom ores and credit from estimated coal sales; excludes $5.4 x 10[6] merchandise sales.

[6]Includes Castle Dome, but cost is before Castle Dome DPC plant rental, which was an additional 2.6c/lb. of total copper.

[7]Derived by crediting profit from consolidated operations per lb. of copper against its prevailing price.

[8]Roan Antelope, Mufulira and Rhokana.

The Real Danger Of High Costs

PLATO MALOZEMOFF
Newmont Mining Corp.
New York, N. Y.

IF METAL PRICES were to drop today to the average of the 1930's, at present costs of production only a few non-ferrous metal mines would long survive. The Canadian coppers and the larger U. S. open-pit operations could produce at a profit, but roughly two-thirds of the world copper production would cease. The effect on lead, zinc and tin production would be even more disastrous, with even the low cost Canadian and Australian lead-zinc producers in difficulty. Small wonder, then, that opinion is almost universal among mining circles that non-ferrous metal prices will find some considerably higher average levels than were current prior to World War II.

Is this a mistaken opinion, as was the similar conviction among many in the flush late 1920's? The 1932-3 drop in prices did not seem to respect cost levels of the bulk of the production and many mines closed down or drastically curtailed, while up-grading, so that in the U. S. production in copper, lead and zinc declined to one-third of 1929 levels. World production (including the U. S.) declined to about one-half.

Subsequent to 1932, prices began to recover, but on the average stayed down well below those of the 1920's, at levels generally thought impossibly low in 1929. Yet, mines began to reopen, production climbed, as costs declined through pressure of lower prices.

The industry has been nervously looking at its costs ever since the initial drop of copper, lead and zinc prices this spring. Perhaps it is the wish that has been father to the thought that prices will not decline below the present cost levels of at least the bulk of the world production.

Not everyone will admit it, but I believe that costs will come down from the present levels if the post-war inflation has by now run its course and deflation follows as it has after every previous post-war inflationary period.

In that case a decline in industrial production would occur and most commodity prices would recede. This would reduce many elements of costs of metal production. In time labor efficiency will improve and technology will continue to contribute towards greater productivity and over-all efficiency.

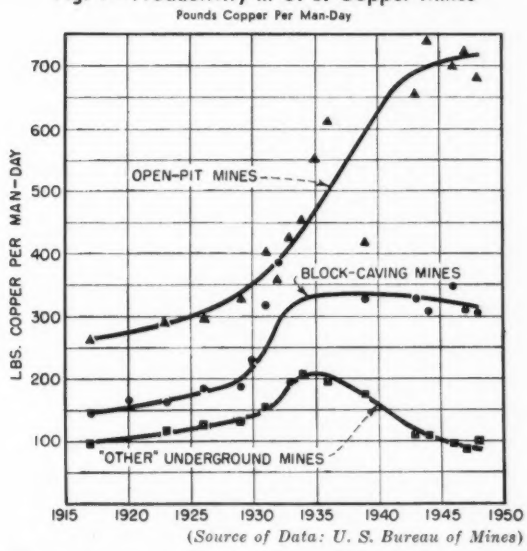
But could costs ever come back to the prewar levels even if we were to experience a severe depression? I think not. The rate of increase in productivity has slowed (see Fig. 1). Our economic and financial structure, our Government-labor-capital relationship, seem to have undergone too deep, too fundamental a change to permit turning the wheels back to prewar levels.

The purchasing power of the dollar has declined to about one-half of that of 1939, and our credit burden and currency inflation are at an all-time high. Nearly everything in our economy is affected thereby, and so will be the basic elements of cost of production of the non-ferrous metals. The same is true of foreign production and for the same reasons.

In the long run, this can only mean higher prices. Lest we take too much comfort in such a prediction, however, it is sobering to remember that price levels of commodities inflated by previous wars have always come back to surprisingly low levels in the postwar deflations (see Table 4).

On examining the long-term trends of prices of some of the non-

Fig. 1—Productivity in U. S. Copper Mines



(Source of Data: U. S. Bureau of Mines)

Through technological advances made in 1930's, productivity rose in all types of mines, but has slowed or declined recently. Part of this is undoubtedly due to lower efficiency of labor obtaining since the beginning of the war, but the curves above are characteristic of all technological or industrial progress in which the rate of increase declines eventually *, unless and until completely new methods come into being.

The sharp decline apparent after 1939 in the case of "other" underground mines, may be appreciably exaggerated from the actual by the statistical method used. For explanation of the method see footnote 2 under Table 8.

Wide variations on both sides of the trend lines drawn are probably due to the variation in the amount of development done (stripping in case of open-pits) in relation to extraction, and to curtailment of production in some operations more drastic than in others, that occurred in the depression of 1930's, when relative weight of several operations varied widely and the average was consequently distorted.

The "other" underground mines up-graded sharply, reaching close to 100 lbs. per ton in 1932-34.

*First pointed out by L. J. Reed and R. Pearl, "The Biology of Population Growth," 1925, and recently further elaborated in E. R. Dewey's and E. F. Dakin's, "Cycles—the Science of Prediction," 1947.

TABLE 2—Prices of Lead, Zinc, Copper, Tin—1920-48

NEW YORK-LONDON (Cents per Pound)

	Average 1920-29 New York	London*	Average 1930-39 New York	London*
Copper	14.4	13.4	9.4	8.2
Lead	7.1	5.7	4.5	3.1
Zinc	6.5°	6.3	4.5°	3.1
Tin	48.8	47.4	41.3	39.9
	1932 New York	London*	1948 New York	London*
Copper	5.6	5.0	22.0	†
Lead	3.2	1.9	18.0	†
Zinc	2.9°	2.1	13.6°	†
Tin	22.0	21.3	99.3	98.60

*Converted from sterling quotation at the prevailing exchange rates. . . †No free market existing. . . °East St. Louis prices.

TABLE 3—1929 and 1932 Price-Production Record for Copper, Lead, Zinc, and Tin

	U. S. Prices, c/lb. 1929	1932
Copper	18.1	5.6
Lead	6.8	3.2
Zinc	6.5	2.9
Tin	45.2	22.0

	Production (000) long tons metal —U. S. A.— 1929	1932	—World— 1929	1932
Copper	931	232	1922	905
Lead	624	252	1753	1181
Zinc	567	188	1467	784
Tin	64*	30*	192	99

*Malaya.

TABLE 4—U. S. All-Commodity Price Indexes in War and Post-War Periods

U. S. Bureau of Labor Statistics, Relatives,* 1926 = 100

	Napoleonic Wars	Civil War	World War I	World War II
5-yr. pre-war average**	86.5	68.0	72.4	81.6
Post-war inflation high	124.8	132.1	154.4	168.9
Primary deflation, 5-year average**	74.3	90.6	99.3	?
Secondary deflation, low	51.7[1]	46.5[2]	64.9[3]	?

*Prior to 1890 indexes prepared by Prof. G. F. Warren and F. A. Pearson, of Cornell; subsequently by U. S. Bureau of Labor Statistics. . . **The 5-year period is arbitrarily chosen. . . [1]Occurring 28 years after the end of war. . . [2]Occurring 30 years after the end of war. . . [3]Occurring 14 years after the end of war.

The war patterns of changes in prices closely parallel. Following a war and an immediate post-war inflation, a primary and quite a sharp deflation occurs, followed by a long secondary deflation that comparatively slowly and gradually erodes prices to even lower levels. Note the rising trend in the war inflation highs and in the subsequent levels.

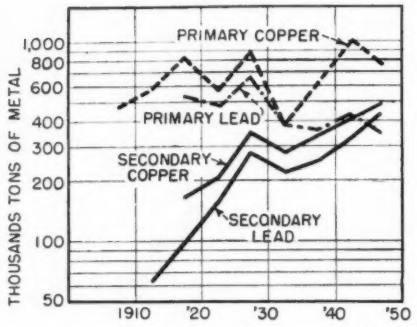
ferrous metals, a reasonable case can be made in support of the contention that copper, lead, zinc and tin prices are now in the phase of a general upward trend. In the simplest terms of new supply from mining, a steady or uniformly rising demand, and the resulting price, a metal passes through three broad stages: (a) youth or scarcity and high prices; (b) maturity or low prices caused by the relative abundance of supply in relation to demand; and (c) post-maturity or "old age." Here prices rise again because of depletion and exhaustion of ready and cheap sources of supply. Costs of production rapidly rise and a vigorous search begins for substitutes for the metal that has become too dear for its market.

This, of course, is an over-simplification of what happens actually, as many other influences exist that distort this simple supply-demand pattern and make the price behavior much more complex. Business cycles, political factors, great improvements in the technology of production, finding great new sources of metal, and salvageable scrap are some of these influences, the interplay of which on metal prices is so complex as to be largely unpredictable not only from year to year, but from one decade to the next.

For example, in the case of relatively indestructible metals like copper and lead, scrap becomes in-

Fig. 2—U. S. Primary and Secondary Copper and Lead Production

Five-year moving averages



(From U. S. Bureau of Mines)

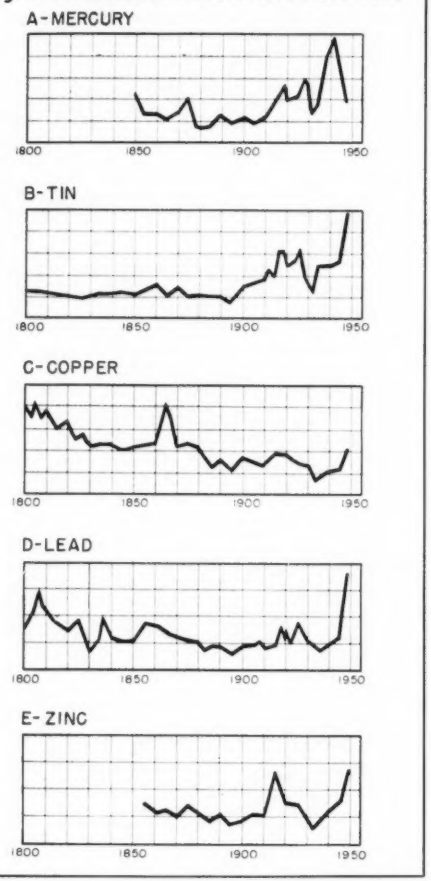
Relatively indestructible metals like copper and lead return to renewed use as scrap after a time, and the amount so returned rapidly increases with the years in an advanced industrial economy. The secondary lead (scrap) recovery has outstripped the primary production in the last four years.

Ultimately, it is conceivable that most, if not all, needs of the industry for these metals might be obtained from scrap, and little or no new mine production would be required.

This appears a relatively distant possibility, at least for our generation, but the effect on metal prices of the increasing recovery of scrap will become more and more important, especially in times of relatively low demand during deflationary periods.

NOTE: The secondary copper recovery in the figure is the so-called "old" scrap, or that obtained from copper-containing products that have been discarded after a useful life, as contrasted with "new" scrap, mostly consisting of processing clippings, borings, shavings, etc., which do not enter industrial use before remelting and subsequent recovery and re-use in fabricating.

Fig. 3—Behavior of Metal Prices Since 1800



creasingly available (see Fig. 2) as new production is consumed in the industry until ultimately a major part, if not all, of needs might conceivably be furnished by scrap.

Yet, in a broad way, the three-stage cycle described probably holds true. Such cycles might actually be repeated and superimposed on the old if some new use of great quantitative importance arises (the case of uranium is an example), resulting in new technology of production, discovery of new deposits, etc.

Perhaps mercury is a fairly simple example that has been essentially unaffected by the influences mentioned, except for business cycles and political factors. Figure 3-a shows the last 100-year period of trend of prices of this metal. The period of maturity and of lower prices is coincident with the intense exploitation of the great Italian and Spanish mines. This was followed by their relative exhaustion, impoverishment of ores, and increases in the price of metal to cover increased costs of the extraction of mercury.

It will be noted that the last trend of increasing prices reflects this phenomenon in spite of the critical economical cycles and the effect of the mercury cartel's policies. Even in the depression of the 1930's when prices of non-ferrous metals have neared or broken their historic lows, the mercury price did not drop to the lows of around $40 a flask that persisted for about a 20-year period from the 1890's to 1914.

Figures 3-b, 3-c, 3-d and 3-e illustrate the long-term price behaviors of tin, copper, lead, and zinc. While the pattern described above for mercury is not quite so plain in the case of these metals, it would appear that with the possible exception of copper, they are on the threshold of a trend of higher prices. If increased and more vigorous search for substitutes is an indication of the "post-maturity" stage, then lead, zinc and tin are probably approaching that stage.

Substitution of a large bulk of lead paints by other pigments, the increasing use of plastics to replace cable lead sheathing; the invasion of aluminum sheet into the galvanized iron, and of aluminum and plastics into zinc die-casting fields; glass, paper and other material containers beginning to replace tin cans, portend the approach of the "post-maturity" stage of these

TABLE 5—Lead and Zinc Ore Grades and Costs[1]

Year	Tons Ore (000,000)	% Concentrate[2] Recovery in Ore Zinc	Lead	Total	Estimated mng. mill cost,[3] $/ton comb. conc.	Ratio of cost to 1939
TRI-STATE						
1935	4.28	6.44	1.06	7.50	20.00	...
1939	5.75	5.91	0.99	6.90	24.60	1.00
1940	6.54	5.43	0.70	6.13	28.60	1.16
1941	8.09	5.00	0.65	5.66	33.60	1.36
1942	8.54	4.41	0.52	4.93	45.60	1.85
1943	9.43	3.39	0.49	3.88	63.40	2.57
1944	9.12	3.31	0.40	3.71	70.10	2.85
1945	7.44	2.93	0.43	3.36	81.80	3.37
1946	8.27	2.72	0.37	3.09	92.20	3.74
1947	6.24	2.91	0.51	3.46	87.80	3.57
TOTAL LEAD ZINC PRODUCTION						
1939	17.26			5.5[4]	N.A.	1.00
1947	25.43			3.5[4]	N.A.	3.20[5]

[1]Derived from "Zinc-Lead Ore Reserves of the Tri-State District, Missouri-Kansas-Oklahoma"—Otto Ruhl, Simeon A. Allen, Stephen P. Holt, U. S. Bureau of Mines, R.I. 4490, July, 1949, p. 21.

[2]"Concentrate Recovery" in Tri-State denotes the zinc and lead recovered from ores in terms of 60% zinc concentrate and 80% lead concentrate.

[3]Before depreciation, depletion and royalty.

[4]Percent metal in ore. J. L. Maury, *Mining World*, July, 1946, p. 16.

[5]See text.

TABLE 6—Impoverishment of Ores

Year	Ave. Tons Ore per Year (000,000)	Yield[1] % Copper
DOMESTIC COPPER MINES		
1910-19	42.4	1.65
1920-29	46.9	1.51
1930-39	32.6	1.46
1940-47	82.4	1.01
NORTHERN RHODESIAN[2] COPPER PRODUCERS		
1939	7.4	3.72[3]
1947	7.7	2.87

[1]1910-36 data from Y. S. Leong and others, "Copper Mining," p. 220, National Research Project, Phila., 1940. For subsequent years, from U. S. Bureau of Mines "Minerals Yearbook. . . [2]Roan Antelope, Rhokana and Mufulira; from annual reports of respective companies. . . [3]Grade of ore produced.

TABLE 7—Impoverishment of Ores, Domestic Lead and Zinc

	1939	1947
U. S. Lead-Zinc lode mines,[1] % combined yield of Pb and Zn	5.5%	3.5%
U. S. Tri-State Mines, % combined[2] lead-zinc concentrate recovery	6.90%	3.46%

[1]J. L. Maury, *Mining World*, July, 1949, p. 16. . . [2]Otto Ruhl, et al., Zinc-Lead Reserves in the Tri-State District, U. S. Bureau of Mines, R.I. 4490, p. 21, July, 1949.

metals. If it were possible, the industry would have fought this competition with lower prices, but costs of production have gone up to the point where this is no longer possible.

The case of copper is less clear. Barring the temporary effects of wars and economic cycles, the period of low prices has persisted from 1885 until about 1940. This period was no doubt greatly lengthened by the advance of technology in the extraction of copper from its ores. The advent of flotation in the late 1910's helped the development of great low-grade porphyry copper deposits and reduced the cost of production of the higher grade ores that were previously smelted directly.

It is not clear from Figure 3-c that copper has now been ushered into the "post-maturity" stage of prices and use. There are, comparatively speaking, as yet few substitutes that have affected the consumption of this metal in modern industry. Aluminum has begun to do this in high-tension transmission lines, but to date its impact has been of small influence in what appears to be an increasing consumption per capita.

Copper may not have reached the stage of scarcity relative to demand, but its production is certainly now a great deal more costly than it has ever been before. The general trend of increasing costs is illustrated by Table 1, showing the production cost per pound of metal before and after taxes and interest in the case of most of the major copper producers in this country and abroad.

These costs have been derived from published sources and in some cases are, of course, only indicative, inasmuch as they are computed from consolidated income statements, which may include other business than mining engaged in by the company involved.

Table 5 shows the increase in costs of producing lead and zinc. While costs per ton of ore in the Tri-State district doubled from 1939 to 1947, per ton of combined concentrate recovery, they increased 3.6 times. This is perhaps an extreme example, as costs were greatly influenced by the rapid depletion of the better grade ores which were already nearing exhaustion before the beginning of the war. Costs of production for all lead and zinc mines (including Tri-State) have about doubled* from 1939 to 1948 in terms of cost per ton of ore and more than tripled per pound of combined lead and zinc metals recovered.**

An important influence on cost of producing metals, one would naturally assume, is the general trend of impoverishment of ores. Tables 6 and 7 show the deterioration in the grade for copper, lead and zinc ores in the United States and for the three important Northern Rhodesian copper mines.

*W. C. Page, in "What Is the Total Cost of Day's Pay Labor?" E&MJ, May, 1949, p. 85, showed that average labor cost per ton of ore increased 2.35 times, and supply cost 2.13 times, with these making up 80 to 90% of the total. His conclusions were based on representative cross-section of the lead-zinc industry.

**Since recoverable grade of combined lead and zinc decreased from 5.5% in 1939 to 3.5% in 1947 in the U. S. J. L. Maury, *Mining World*, July, 1949.

The decreasing trend in grade of U. S. copper ores has taken place despite the fact that some great producers, such as Utah Copper, Miami, Inspiration and Butte mines, have maintained their grade with little variation in the last decade or two.

The over-all grade has been declining partly because of exhaustion of smaller, high-grade mines, partly owing to the other large mines, not named above, expanding for additional ore into lower-grade limits of ore that was previously considered waste, and because of bringing in large new lower-grade open-pit producers, such as Morenci and Castle Dome. The non-ferrous mining industry has fought the rise in costs due to this impoverishment rather successfully with technological improvements, mechanization, and greater capacity of unit operations.

Even as long ago as in 1929 a larger producer like Miami was mining ores that yielded only about 11 lbs. of copper per ton at costs competitive with those of much higher grade producers.

Today there are four large domestic producers that mine ores

TABLE 8A—Productivity in Different Classes of U. S. Copper Mines

Year	OPEN-CUT[1] Total[2] lbs. Cu. (000,000).	Yield[3] lbs./T	Prod.[5] lbs. Cu. M-Day	BLOCK-CAVING Total[2] lbs. Cu. (000,000)	Yield[3] lbs./T	Prod.[5] lbs. Cu. M-Day	OTHER UNDERGROUND MINES Total[2] lbs. Cu. (000,000)	Yield[4] lbs./T	Prod.[5] lbs. Cu. M-Day	ALL MINES Total[2] lbs. Cu. (000,000)	Yield[3] lbs./T	Prod.[5] lbs. Cu. M-Day
1917	386	18.3	261	245	23.1	145	943	47.8	94	1,574	30.6	119
1923	352	19.1	295	252	22.9	161	749	61.0	116	1,353	31.0	147
1926	479	19.0	297	283	20.1	181	847	57.9	125	1,609	29.0	161
1929	561	18.3	328	314	18.3	186	999	57.7	127	1,874	28.3	166
1936	452	19.5	551	....	[6]	....	775	72.1	195	1,152	30.2	289
1939	602	18.3	418	213	19.8	328	541	52.7	171	1,356	25.8	258
1943	1,182	17.4	652	302	19.2	328	500	44.7	103	1,984	21.8	262
1944	1,110	18.0	740	203	16.3	307	406	36.1	107	1,719	20.9	289
1946	720	17.3	700	164	17.4	348	192	27.6	92	1,076	19.1	300
1947	1,160	17.8	723	170	16.0	310	218	29.0	83	1,548	18.9	324
1948	1,142	17.6	680	170[7]	16.2	304	262	35.6	97	1,574	19.3	318

NOTES: Sources of Data: 1917-1936—Y. S. Leong, et al., "Technology, Employment and Output per Man in Copper Mining," WPA, and Bureau of Mines Natl. Research Project, Report No. E-12, 1940. . . 1939-48—Private Communication, U. S. Bureau of Mines.

[1]Includes some underground production from the Ruth mine after 1939, from Morenci in 1939, and from Bagdad in 1948.

[2]For 1917-36, total copper content of ores, excluding tailings retreated and precipitates; for 1939-48 this figure was not available and was obtained indirectly by multiplying the yield figure (see [3]) by tons of ore exclusive of waste, tailings, etc., retreated. The result tends to understate copper production, and consequently productivity too, of the "other" underground mines for 1943-48, when there was a very large tonnage of low-grade waste, tailings, etc., processed by these mines, and the regular mine production was reduced because of labor shortage.

[3]Yield, i. e., copper recovered, from ore including tailings, etc., retreated and including precipitates.

[4]Same as [3] for 1939-48; for prior years excludes tailings, etc., and precipitates.

[5]Total lbs. copper divided by man-shifts worked at mines, including surface labor attached to underground mines, but excluding labor used in beneficiation plants and smelters. Productivity of "other" underground mines is probably understated for 1943-48 for reasons stated in footnote 2.

[6]Figures are meaningless for showing the general trend of productivity as affected by technology: depression conditions caused curtailment of some operations more drastically than others, thus distorting the average.

[7]Includes some copper from the Inspiration open-pit mining operation.

TABLE 8B—Relative Importance of Production of Different Classes of Copper Mines

PERCENT OF TOTAL U. S. COPPER METAL PRODUCTION*

	Open Cut	Block Caving	Other Underground Mines	Total %	All Mines Millions lbs. Cu.
1917	24.5	15.6	59.9	100.0	1,574
1923	26.0	18.6	55.4	100.0	1,353
1926	29.8	17.6	52.6	100.0	1,609
1929	29.9	16.7	53.4	100.0	1,874
1939	44.3	15.7	40.0	100.0	1,356
1943	59.6	15.2	25.2	100.0	1,984
1944	64.6	11.8	23.6	100.0	1,719
1946	66.9	15.2	17.9	100.0	1,076
1947	74.9	11.0	14.1	100.0	1,548
1948	72.6	10.8	16.6	100.0	1,574

*Derived from Table 8.

yielding 11 to 14 lb. copper per ton, three by open-pit and one by block-caving, two of these being among the lowest cost producers in the United States. That important new production will be derived from similar low-grade ores is augured by the finding of the great new source of copper, San Manuel in Arizona, with over 450 million tons of about 0.8% copper ore.

It would appear, then, that for the time being at least the diminishing grade of copper ores mined in the U. S. has on the whole not been a factor responsible for the rise in cost of copper production. The impoverishment of the U. S. lead-zinc ores, however, on the average has probably affected permanently the domestic production costs of these metals. No examples of the larger producers' costs of these metals are possible, however, because they all conduct integrated operations including custom smelting and marketing.

The elements of costs that have been mainly responsible for rise in production costs are those common not only to non-ferrous metal mines but to the whole industrial production in general.

1. Increased wage rates.
2. Decreased labor efficiency.
3. Increased cost of materials, freight, refining and marketing.
4. Increased burden of labor fringe benefits.
5. Increased taxation.

The wage pay per shift in lead-zinc mining, for example, has more than doubled* since 1939, when the additional cost of incentive payments and overtime are included. The cost of labor has been further increased by the so-called fringe benefits, which include unemployment, life, and medical insurance, F. O. A. tax, Occupational Disease and Industrial Accident Compensation, vacation bonus, separation pay, hospital expense, pension and welfare benefits.

In the case of Magma, for example, these benefits alone have about tripled since 1939. It has been estimated* that they now make up 20-25% of straight time rate for day's pay in the lead-zinc industry. These are the costs that are essentially irreducible. While in a deflationary period, wage rates recede somewhat—and in some sections of the mining industry they already have this year—if only drawing from past history, one might confidently predict that the wage rates of 1939 will never return.

The fringe benefits, of course, are here to stay and labor's insistence on further health and welfare benefits that we are currently

*W. C. Page, ibid.

experiencing promises that they will further increase to some as yet unknown important extent in the case of non-ferrous metal industry. In addition to this, there are the less easily evaluated increased costs of securing better working and safety conditions that industry is providing for labor now.

Labor costs are further increased by the reduced labor efficiency that has occurred in great sections of the industry during and since the war. Thus, at Magma, where underground conditions are exceptionally difficult, the total labor cost per ton has almost tripled from 1939 to 1948, while the wages per shift, including contract payments and bonus, have gone up about 80%. While this is in part due to change in conditions with depth, it does reflect the lower productivity of the labor engaged in the same tasks.

At Consolidated Coppermines block-caving operation in Nevada, the tons ore per underground shift have decreased from about 20 in 1939 to 9 in 1947, and had recovered to but 11½ in 1948.

For the bulk of the industry, however, it is impossible to judge the labor efficiency in terms of productivity because of the off-setting effect of rapidly increasing mechanization. Thus, Table 8A shows that productivity of all copper mines in terms of pounds of copper mined per man-day has risen by about 120% in the first decade after World War I and more slowly after that.

The main advance in productivity occurred in open-pit mines (see Fig. 1), and because these mines contributed an increasingly important portion of the total domestic production, reaching over 70% of the total in 1947 and 1948 (see Table 8B), they tended to lift the productivity of the whole industry average.

The underground mines, dependent as they are on large numbers of skilled miners, are most sensitive to variations in labor efficiency, but Fig. 1 would seem to indicate that in some measures at least the lack of advance in productivity in these mines is inherent in the relatively smaller improvement that can be made by technological advances, and in the fact that the preponderant number of these mines are quite old and some are reaching the exhaustion stage.

As a result of inflation, the cost of supplies has greatly increased. W. C. Page* estimates that for lead-zinc mines the basic prices have about doubled since 1939. Freight rate increases, he points out, have further accentuated the basic supply costs delivered at the mine. He shows that the supply costs per ton of ore have augmented 2.65 times, which probably points to the additional factor of the role of labor in the use of these supplies.

At present, because labor is less skilled than that which was employed in the mines in 1939, greater degree of waste in the supplies may occur and shorter life and greater use of replacement parts are required because of poorer care of machinery. The costs of freight, refining and marketing have increased as well. At Consolidated Coppermines, for example, freight, treatment, smelting and refining have gone up from 5.4c. in 1939 to 10.6c. per lb. copper in 1948.

Taxation has been a very important factor of increase. While the income taxes in 1948 were very high because of higher margin of profits that most mining producers experienced, the rates of income taxes have greatly increased since before the war, so that even at the lower prices, the taxation burden would now be an important proportion of the total cost. Production taxes have been levied in several states. In Chile a portion of increased price of metals is taken by the Government. Mexico charges taxes on production and export of metals.

Besides the direct taxation, many producers are faced with increased costs that might be termed as indirect levies. Thus, in the case of Chilean producers, the labor must be supplied from company stores at controlled level of prices that is below the cost of these supplies. In defraying local costs, artificial rates of exchange must be used in converting the dollars

*loc. cit.

TABLE 9—Effect of General Deflation on Costs[1]

	1929	1930	1931	1932	1933	1934
Granby (all units) cost, c/lb.[2]	10.6	9.8	6.8	5.6	6.7	7.7
Cu, lbs./T produced	24.5	21.2	23.2	22.2	22.5	19.6
Magma, cost, c/lb.[3]	8.9	7.6	7.4	7.1	6.4	5.2
Cu, lbs./T produced	142	127	125	145	136	121
United Verde Ext., cost,[3] c/lb.	8.4	8.3	7.1	5.5	6.3	6.6
Cu, lbs./T produced	N.A.[9]	N.A.	134	148	137	134
Miami, cost, c/lb.[5]	11.7	10.9	9.9	14.4[8]	...[10]	...[7]
Cu, lbs./T produced	11.7	10.95	11.4	11.1	...	...
Inspiration, cost, c/lb.[5]	11.1	9.7	8.4	...[7]	...[10]	...
Cu, lbs./T produced	18.6	21.5	23.7	...	...	...
Kennecott Group, cost, c/lb.[4]	9.5	10.9	8.7	9.6	...	...
Cu, lbs./T produced	21.4	22.2	19.5	18.9	...	...
Chile Copper, cost, c/lb.[11]	4.9	6.1	6.0	6.1	5.2	5.0

[1]Except for Magma and Chile Copper (data for which were derived from annual reports), all other data are from "Copper Mining in N. America," Gardner, Johnson and Butler, U.S.B.M. Bull. 405 (1938).

[2]Before depreciation, depletion and income taxes.

[3]After depreciation, but before depletion and income taxes.

[4]Properties now belonging to Kennecott: Chino, Copper Flat, Ruth, Ray. After depreciation and precious metal credits, but before Federal taxation.

[5]Before depreciation and depletion.

[6]Includes depreciation, excludes depletion and Federal taxes.

[7]Mine closed part of period.

[8]Cost higher apparently owing greatly reduced production.

[9]Unavailable.

[10]Shut down.

[11]After depreciation, obsolescence and miscellaneous income, but before taxes and interest.

TABLE 10—Effect of Business Cycle on Costs of Magma

Year	(000) Tons ore	(000,000) lbs. Cu.	Yield Cu lbs./T	Productivity[2] Tons ore/ man-day	Costs[1] c/lb.	Cost[1] $/ton ore	Miner's Wage $/shift
1926	249	29.0	116.5	1.69	7.90	9.21	5.00
1927	222	27.5	123.8	1.52	8.60	10.63	5.00
1928	263	35.2	133.8	1.70	8.12	10.87	5.05
1929	270	36.5	135.2	1.67	8.89	12.02	5.75
1930	252	31.6	125.3	2.13	7.56	9.46	5.30
1931	232	28.8	124.1	2.76	7.39	9.17	4.95
1932	149	21.7	145.7	3.25	7.10	10.33	4.95
1933	145	19.6	135.2	3.32	6.41	8.66	4.70
1934	264	31.6	119.8	2.93	5.24	6.28	4.95
1935	260	29.7	114.2	2.92	5.16	5.89	5.00
1936	274	30.3	110.6	2.54	5.28	5.83	5.05
1937	302	31.0	102.7	2.49	7.27	7.47	6.00

[1]Before depreciation, depletion and federal income taxes, but after amortization of pre-paid development, sundry metal credits, freight, refining and marketing charges.

[2]Using man-days employed in mining and all surface labor serving the mine, but exclusive of mill and smelter labor.

brought into the country at levels as low as one-half those of the free exchange, which constitutes a government levy that is tantamount to taxation. These indirect levies constitute an important proportion of the direct costs of operation.

As economic difficulties of foreign countries grow more complex with shortages of dollar exchange and the change from a seller's to a buyer's market, the governments are faced with reduced revenues from taxation, while their costs, inflated by greater generosity in labor welfare payments and by larger bureaucratic apparatus, are steadily going up. How this dilemma will be solved by these governments remains to be seen. That it may resolve in either higher rates of taxes or some new taxes is probably as good a guess as any.

Can Costs Come Down?

While the upward trend of costs has been steep in the past ten years, there are grounds for expecting that this trend might be temporarily arrested and the over-all costs will go down to a certain extent. It would appear that we are now in a period of recession or deflation, and in such a period certain important reductions in costs have occurred in the past and can reasonably be expected to do so in the future. A deflationary atmosphere seems to have a considerable influence on both the labor efficiency and general efficiency of operations.

Table 9 shows the period immediately following 1929, when costs in the case of some of the producers definitely trended downward. This trend is not so evident in the case of the larger producers, who had to curtail production drastically in the early 1930's in order to keep supply more or less in balance with the greatly reduced demand. That is the main reason why the downward trend is not apparent in the case of Miami, Kennecott group, and Chile Copper in the tabulation. Yet a reference to Table 1 will reveal the decrease in costs from 1929 to 1939, which is illustrative of the deflationary influence of the 1930's.

Table 10 shows some details of costs, production, and productivity in the case of Magma from 1926 through 1937, which covers approximately a full economic cycle of inflation. It is to be noted that costs increased through 1929 and decreased greatly in the 1930's, reaching a low during a period when demand for copper and prices improved somewhat, i.e., 1934, 1935 and 1936. The still greater demand for copper and higher commodity prices drove costs upward again in 1937.

The increase in productivity paralleling the lowering of costs is also striking and results from the general stringency of economic atmosphere when jobs are hard to get and those that have them work harder in order to keep them. This same effect no doubt contributed to an important degree to the sharp rise in productivity in underground mines in the early 1930's, shown in Fig. 1.

This general effect on labor productivity no doubt will repeat itself to a certain extent. Admittedly, labor efficiency has in the last few years been close to its all-time low, especially as regards its diligence, absenteeism, and poor skills. Most of the skilled labor was lost to the mining industry early in the war and has not returned; it will probably never fully return. This means that a new crop of miners must be educated to the jobs. It should be reasonable to expect that with experience, skills will improve. A deflationary atmosphere will no doubt cause improvement in diligence and reduce absenteeism.

That management has a large role to play in the control of costs is, of course, undeniable. Rapidly rising costs, because of war-induced factors beyond the management's control, may have been at times a convenient excuse. The Premium Price Plan subsidies during the war have, in my experience in Washington, been in certain cases a demoralizing influence. When things would get out of hand, it was an easy matter to apply for an increased subsidy on the grounds of higher costs. Poorer metallurgical recoveries, lower productivity, lower grade of ore mined were reasons enough to require the Government agencies to consider such a request favorably. It was impossible with the staff available to ascertain in every case whether any of these causes were remediable.

Similar influence may have been exerted by the rapid rise of prices after the war. Because the margin of profit widened so rapidly there was no great economic compulsion to start cutting costs and tightening up the operations all along the line. Faced with so much higher costs, greater effort and ingenuity than ever is required of the management to recover the lost efficiency, and at least partly to offset the new irreducible elements of costs by new economies in the more flexible elements of production costs.

The gradual improvement of the subordinate supervisory personnel will no doubt occur through self-training, experience and through management's help and direction. The improvement in efficiency of labor, however, is a larger and much more difficult problem. Some mining companies have initiated training programs and schools to improve the quality of the skills of the labor force engaged. Sole reliance on labor's own initiative and ingenuity to improve itself or depending on chance applications of experienced labor in the rustling lines appears no longer feasible. Perhaps there are lessons to be learned from the manufacturing industry, which has applied training methods on a large scale for a long time.

Ingenuity Required

A more efficient utilization of the engaged labor is possible through the use of more economic methods or procedures initiated through the ingenuity or the invention by the management or the experts it consults, or by applying suitable procedures used elsewhere. In this connection, a wide distribution of information among mining companies is helpful. Here, again, perhaps lessons can be drawn from the manufacturing industry, where because of greater competition than in mining in making lowest costs possible, methods for testing, analyzing and improving elements of operations and efficiency of organization have been highly developed and are widely applied.

It was evident even during the war that productivity of labor in certain categories has deteriorated more than in others. Particularly difficult was maintaining efficient functioning of the auxiliary nonproductive services, such as surface labor, underground maintenance and clean-up, transportation of supplies, materials handling, mechanical repairs, etc. Deterioration of these services often escapes ready detection or control because of the difficulty in applying numerical criteria for its efficiency.

Better labor relations, incentive programs, safety programs and better working conditions at the mine are all factors with which management can try to raise the general morale of labor and work towards improvement in the labor efficiency. Greater awareness of labor of the role it plays in maintaining the prosperity of the given enterprise, and through it that of the

country, is a step to this end as well. Examples of several such measures employed by Hollinger, in Canada, and Climax, in Colorado, will be found on other pages of this issue.

In some cases, especially those of large, complex operations, improvement in costs can sometimes be made through critical analysis of costs and other records. Some elements of operations are otherwise difficult to control. For example, an extraordinary increase in overhead and indirect costs might reveal just the sort of deterioration of non-productive services that is mentioned above.

Over-mechanization might be indicated when depreciation and amortization of machinery offsets the economies effected by such mechanization. Excessive maintenance of underground openings might point to insufficiently permanent supports and a more costly but more permanent substitution of these supports might be indicated.

Excessive maintenance cost of openings might indicate indirectly over-development of a mine. While management always strives to maintain adequate reserves ahead of production, it is sometimes uneconomical to do so much ahead of production in heavy ground that renders long maintenance of development headings prohibitive.

An improvement in over-all costs and profits can sometimes be achieved through better coordination of cut-off grade of ore mined with metal prices and profits. This coordination requires the knowledge of an expert in taxes.

All these measures can contribute to making economies and lowering costs. While important reductions can and will be achieved, and at some operations more than at others, their over-all effect will likely not bring costs of producing copper, lead, zinc and tin down to the prewar levels. Too much of the increase in costs has been because of certain irreducible, or nearly so, factors discussed in this paper. Hence the conclusion seems inescapable that to continue producing these metals at levels to permit even much reduced economic activity compared to that at present, prices must keep pace with these increased basic costs.

Over the years, the average levels of prices, even though we may suffer a serious depression, will still be higher than they were before. This general trend is probably gradually bringing some of the nonferrous metal industries nearer to the critical period when these metals will become too dear for some of the uses they are put to, when substitutes will begin to replace their use on a large scale, and their consumption is reduced. There are indications that lead, zinc and tin are approaching this period.

The greater effort that is made in keeping costs and therefore prices down, through technological improvements, greater over-all efficiency, and through the vigorous search for additional sources of ore, the longer delayed will be the day of reckoning when markets for these metals begin to dwindle because of over-pricing.

A Non-Metallic Producer Reduces Costs

SIX WAYS IN WHICH REDUCTIONS are being made in the cost of mining phosphate rock, resulting in substantial direct and indirect savings, are described by W. H. Gabeler, manager of Davison Chemical Corporation's Phosphate Rock Division at Bartow in the Florida pebble field. The means employed are:

1. Planning at Long-Range. The company is doing more thorough prospecting and better long-range planning of mining work. The thoroughness of such prospecting is a matter of great importance. Some mines find it necessary to prospect only to the extent of four holes per 40-acre tract. Others deem it necessary to put down 8, 16 or even 32 holes on a tract of this size.

2. Making Supervision Cost-Minded. Budgeted cost data are being made available to the direct supervision responsible for each unit of operations. This is one of the most important factors in cost reduction, in the management's opinion. Some of the supervision have become so cost-minded that they can forecast the operating cost for their unit within a penny or two of the results calculated by the controller's office. All realize that any over-run against budgeted figures will have to be explained. At the same time, they are given full credit for meeting or bettering the budget.

3. Fostering Improved Employee Relations. Better industrial relations have been established and an active safety program has been set up. Labor efficiency has been improved by job evaluation and classification. A job-evaluation program has been completed this year for salaried employees. An agreement has also been negotiated with the local union which provides for a job evaluation program for hourly-paid employees, to be worked out by a committee composed of members selected from the management and the union. It is felt that this is a big step to a more efficient use of labor and to better cooperation between management and labor. The company's active safety program is reducing the amount of lost time and the labor turnover. June, 1949, was the first month to be free of lost-time accidents.

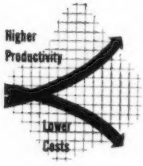
4. Checking Efficiencies. A Process and Quality Control Department has been installed for the continuous checking of efficiencies of unit operations and quality of products. This has brought to light many little inefficiencies in operating procedures and has set standards for better quality and more efficient operating control. The department has also disclosed projects for research which are resulting in improvements in design and in flowsheets.

5. Controlling Maintenance. Supervision and control of maintenance have been improved. The latter has been achieved by card-indexing each piece of equipment properly, giving its initial cost and the cost of maintenance. This has made it possible to install a better preventative-maintenance program and to devise a more efficient replacement schedule.

6. Continuing Research. Research is continuous in the effort to secure more efficient mine, process and handling equipment. The company's engineers are being allowed more free time for the study of technical literature, in an attempt to broaden their knowledge of such equipment.

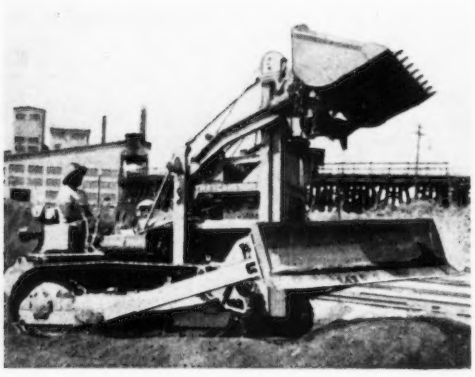
LOADING ORE into railroad cars from stockpile at Midvale smelter.

How U. S. Smelting Attacks Problem of Cost Reduction AT ITS MINES, MILL AND SMELTER



BASIC TO ANY EFFORT to lower operating costs, there must be certain controls over the costs of labor and supplies, and, in addition, there must be an increase in the efficiency of labor, which leads to increased output per man-shift. This is the view of the staff of United States Smelting, Refining & Mining Co. The problem is not new, but the stipulations are fundamental.

Supervisors Must Become Cost-Conscious. To control labor and supply costs, thereby to control op-



SPREADING GRANULATED SLAG on tailings dump, Midvale.

STACKING 4-TON BUNDLE of timber with fork-lift truck.

erating and maintenance costs, it is first necessary to know the "how much" and "what for" of these basic expense items. The reasons for any marked increases or decreases must be traced down to the direct operating source by the operating supervisors. This should make a supervisor cost-conscious. He will have a better idea as to where and for what the money is being spent, and whether such spending is necessary or unnecessary. Once it is realized that a labor shift in a mine, mill or smelter costs anywhere from $12 to $15 and that supplies for operation or maintenance are the equivalent of so much hard cash, more careful judgment will be exercised in the use of these two major items.

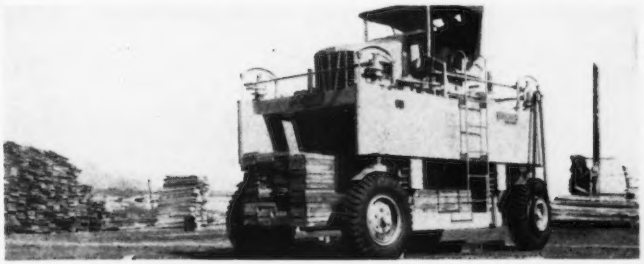
From all this it follows that the economic education of supervisory personnel plays an over-all part in cost reduction. Results should be found in the better planning of work, improved maintenance of plant and equipment, and in new ways devised for saving labor.

Employee Relations Exercise Profound Effect. Whether the company's relations with its labor and other personnel are sound or unsound will affect costs and efficiency, directly or indirectly. With this in mind, the U. S. Smelting management makes every effort to stimulate cooperation between itself, its supervisors (who are an integral part of management) and its labor. The establishing of sound relations, in its opinion, once such relations become coordinated and continue to be actively and intelligently stressed, constitute the most important phase of providing the basic requisites for controlling and reducing costs.

Mechanize, Modernize. Each operating unit has a cost research engineer who makes individual cost surveys of the various phases of the operation. He provides the unit superintendent with detailed cost analyses and makes recommendations as to cost reductions and controls.

The value of mechanization is emphasized as a means of reducing labor costs wherever feasible. The desirability also of modernization is constantly stressed, particularly when a survey shows that repair and maintenance costs exceed the prorated capital cost of newer, improved machinery and facilities.

Time Studies, Work Cycles. As in the past, detailed stope and drift studies continue to be made to determine more efficient use of explosives, drill rounds, drilling equipment including detachable bits, and mechanized equipment. At intervals, time studies are made of work cycles, as in hoisting, tramming, pumping, slushing, and handling supplies and distributing them from the surface through the mine.



TRANSPORTING a 4-ton bundle of mine timber to the asphalt-paved storage area at the United States and Lark mine.

Exchange of Ideas Promoted. Integrated cooperation and communication are of prime importance for a sound and healthy operation. To attain it, weekly supervisory staff meetings were begun some years ago. The main objectives were to present and exchange ideas and constructive criticism on the analyses and reduction of costs, operating procedures, labor policy and future plans.

At the start, the meetings were stiff, with most supervisors ill at ease and silent. Gradually they came to realize they were on the same team, striving for a common objective. Although disagreements were, and still are, sharp, eventually a solution or procedure is determined which involves the effective meshing of all departments or units concerned. Many sound and practical ideas from the lower-bracketed supervisors have resulted. It is felt that two-way communication between management (of which the supervisors are definitely a part) and labor now exists on a basis that is becoming more and more sound. Close cooperation and planning between the operating and maintenance departments for preventing breakdowns and integrating repairs with operations is now reducing lost time to the smallest amount possible.

Attendance at the weekly and monthly staff meetings at the mines generally includes the Manager of Western Mines, the General Superintendent, and the Cost Research Engineer, and all operating and service department foremen. Combined weekly supervisory staff meetings are held at the Midvale plant, which comprises the lead smelter and flotation mill. Here all department heads are present, as well as the General Plant Superintendent, the Director of Research, Cost Research Engineer, and the Assistant General Manager of Western Operations.

How Mechanization Helps. For years, the company has been mechanizing wherever possible, by way of saving labor. Recently it adopted gasoline-powered heavy-duty fork-lift and straddle truck units to unload, transport and stack mine timber, pipe, rail and heavy equipment around the mine yard. It is estimated that the labor saving on the timber handling alone will pay for a $15,000 fork-lift-straddle combination in about two years.

Rubber-tired material-handling equipment, like the above, will eventually eliminate much mine-yard track and overhead trolley wire, reduce storage space, and make for better housekeeping. A straddle truck recently has been used at a considerable saving over regular truck haulage to transport heavy equipment and supplies over gravel roads with grades up to 20% from a main unloading and storage area to various operating shafts a number of miles apart.

At the Midvale plant the equipment shown in two of the illustrations has been recently acquired. With the bulldozer-blades and crane-hook attachments this equipment can be used for a variety of purposes, such as general yard and track cleanup, loading and unloading supplies and heavy equipment, loading stockpiled ores, diking the tailings, spreading slag, snow plowing, and similar tasks. It is estimated that the labor saving will pay for this equipment, which cost about $25,000, in about three years.

REVISION OF INCENTIVE RATES, as for scraper-mucked cut-and-fill stopes, was discussed with employees in meetings like this.

Hollinger's Wage Incentive

J. W. THOMSON

Superintendent
Production Engineering Department,
Hollinger Consolidated Gold Mines,
Ltd.,
Timmins, Ont.

MINING CONDITIONS at the Hollinger gold mine in Northern Ontario are best described as the horizontal cut-and-fill extraction of many scattered, nearly vertical vein-type orebodies. The size of these bodies ranges from 3 to 50 ft. in width, averaging 11 ft., and up to several hundred feet in length. Activity at present is well distributed between surface and the lowest stoping level at 3,650-ft. depth, with development being carried on for a further 1,500 ft. vertically. A wide variety of rock conditions is encountered in both stoping and development work, affecting the amount of necessary work in drilling, scaling, and ground support.

THE PRINCIPAL OBJECTIVE of the various incentive plans for labor used by Hollinger Consolidated Gold Mines Ltd. at its Hollinger mine at Timmins, Ont., is to reach and maintain a high level of production by relating effective effort to wages earned. This usually results in a cost per unit that is considerably lower than when the same operations are carried on without an effective wage incentive plan.

New Scheme Sold

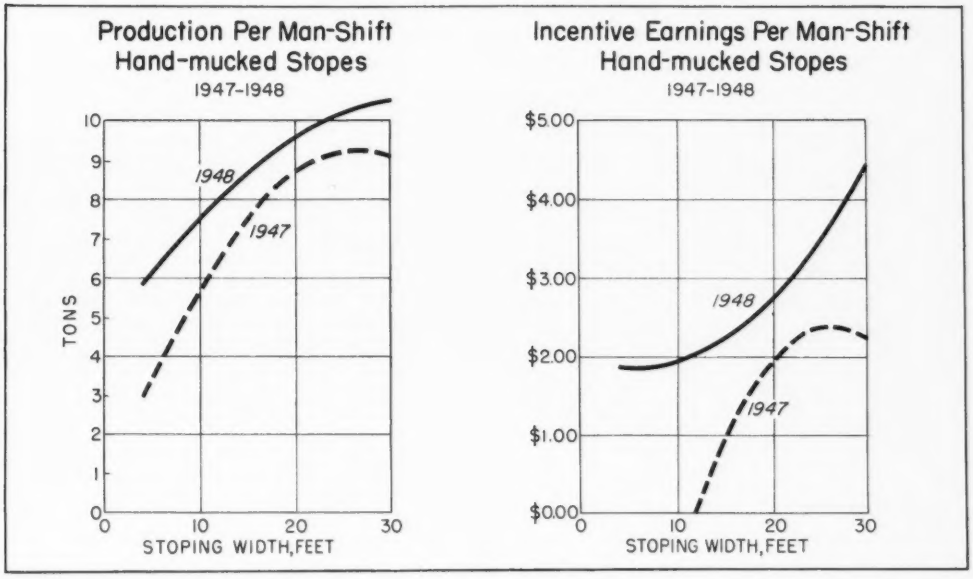
Most of the Hollinger plans can be classified as "piece rate," with the worker keeping all earnings whenever the required standard output is exceeded. Basic hourly wages are guaranteed in all plans and no maximum is placed on incentive earnings. The company policy respecting wage incentives has been made clear to those working under the plans in the following statements:

1. Payment of incentive earnings will be made in proportion to the amount of work done in excess of a standard requirement.

2. As near as practicable, the same opportunity will be provided for earning incentive pay throughout all phases of an operation and where skill and effort requirements are similar.

3. Wage incentive rates will be established so that an average competent worker can earn 25 to 30% of his base wages in extra earnings, for a sustained output throughout the working shift.

Complete application of these principles is tied in with such things as the basic wage structure, the cost of accurately and consistently measuring a "fair day's work," the cost of administering incentive rates, and the almost unlimited variety of underground working conditions. Nevertheless, it was realized that the acceptance of the company's intentions by both supervisors and workers was a prerequisite to the successful operation of any incentive scheme. To this end, meetings were held, written



REVISION OF RATES for hand-mucked stopes in 1948 resulted in improvement of productivity and incentive earnings per man-shift.

System Gets Results

material was posted on bulletin boards, and two-way informal discussion was encouraged among all concerned.

Old System Outmoded

Historically, the original production "contract" rates were set as a result of estimates of what could be turned out by the average miner in a shift under average mine conditions existing at the time. Basic wages rose and mining conditions became more difficult, which were only partially balanced by some improvements in equipment. Only the occasional adjustment of piece rates took place over a 17-year period. A property-wide survey of incentive earnings in stope production during 1944, 1945 and 1946 made it evident that the incentive system required a complete revision to correct the existing unbalanced opportunities for extra earnings. In 1947, a production engineering department was set up, separate from the main production departments, for the purpose of making a full investigation of the work-measurement and wage-incentive problems. While serving apart from the direct-line organization, this department was staffed from the mine's supervisors and has worked in close co-operation with all levels of supervision.

The initial survey indicated that the incentive plan for stope production had grown inadequate over the years. Over half the men working under the scheme were earning no incentive pay and more than 10% were able to increase their basic wage by half as much again. Production per man-shift had been declining with the gradual disappearance of any real incentive to work.

Move to Correct

All available past production records were examined, time-study techniques were installed by a consultant, and piece rates were revised, as inequalities became evident through detailed study and analysis. The first step in correction was to revise the stope breaking rates, based on a combination of past performance and available time-study data. The revisions went into effect in January, 1948. Revisions of rates for other parts of stope operations followed during the year, with increased use of information obtained by time study.

Where previously the stope breaking rates were constant for all stope widths above 6 ft., they were graduated according to width from 3 to 20 ft. Where shovel-mucking and scraper-mucking rates had been constant for any length of tram or haul, these were also made to vary with distance conditions. In effect, where working conditions or equipment make an appreciable difference in the output, an effort is made to change the standard day's work requirement accordingly. This is done by adjusting the piece rate or, if the condition is of short duration, by making suitable time allowances in the contract labor charges. Part of the schedule of mucking rates for scraper-mucked, cut-and-fill stopes is shown on page 85.

Time Studies Adopted

While detailed past-performance records have been and are still used to establish production standards over a range of conditions, time-study measurement of work is recognized as the most satisfactory method of setting a "fair-day's work." Although no labor union

HOLLINGER CONSOLIDATED GOLD MINES LIMITED

PERIODICAL INCENTIVE STATEMENT

CONTRACT NO. 307 PERIOD ENDING Aug - 12 - 49

LEVEL	LOCATION	ADVANCE FOOTAGE	BREAK OR SLASH	WIDTH	RATE $	AMOUNT	
950	220-4 (220 A W M 1)						
	C & F Wheelbarrow						
	Ore Tons Broken		97	5.52	0.91	88	27
	" " Mucked free run		19		0.17	3	23
	" " " non-load		78		0.30	23	40
	" " " load (0-30)		52		0.52	27	04
	" " " " (30-55)		60		0.55	33	00
	Waste Tons Broken		27	8.00	0.73	19	71
	" " "		85	5.52	0.91	77	35
	" " Mucked non-load		15		0.30	4	50
	" " left as fill		87		0.15	13	05
	Fill by car (0-90)		104		0.29	30	16
	" " " (90-130)		91		0.30	27	30
	Millhole adv. (comb)	23			3.50	80	50
					TOTAL	427	51

CONTRACT	CLASS	WIDTH
COOK NO.	7	6

	ORE	WASTE	TOTAL
PREVIOUS BALANCE	112		
BREAK	97	112	209
TOTAL	209		
MUCKED	209		
BALANCE	—		

MEASUREMENTS & PRICES CORRECT

CHARGES EXTENSIONS CORRECT

AUTHORIZED FOR PAYMENT

HOLLINGER CONSOLIDATED GOLD MINES LIMITED

PERIODICAL INCENTIVE EARNINGS STATEMENT

PERIOD ENDING

CREDITS FORWARD	427	51
BASE ADJUSTMENT HOURS @ 100		
LESS LABOUR	311	61
	115	90
LESS EXPLOSIVES	53	21
NET	62	69

CONTRACT CLASS	SUPERVISION	CONTRACT NUMBER	CLOCK NUMBER	HOURS WORKED ON CONTRACT	HOURS WORKED ON ALLOWANCE	HOURS WORKED ON TOTAL 1 AND 2	INCENTIVE PER HOUR	INCENTIVE AMOUNT	
7-6	4 1 1	307	1120	187	5	192	0.16	30	70
			3874	8		8		1	28
			4292	187	5	192		30	70

CHARGED TO CONTRACT

EXPLOSIVES		LABOUR						
53	21	311	61		382	10	392		62	68

AN INCENTIVE STATEMENT is issued periodically to each crew, of two or more men, covering activities and earnings of the crew for the period.

contract with the company exists, the time-study principles and techniques that were adopted have been explained to the men through discussions at meetings when rate changes were made and through contacts underground on the job.

An added advantage derived from using time studies for setting rates has been a more exact and detailed definition of what work is to be done and how much time is allowed per unit of production for every "element" of the job. Also, the methods used during the time-study observations come under close scrutiny for possible elimination of production hold-ups, for ineffective use of equipment, and for possible improvement in planning the work cycle. It was realized early that the character of gold-mining operations at the Hollinger (mainly its unpredictable changes and its geographical distribution) put a limit to the amount of useful detail that could be profitably gathered. But the approach to the engineering and planning of the work is best expressed by the principle that work can be planned only as thoroughly as its components are analyzed and studied.

Productivity, Earnings Rise

Results of the 1948 rate revisions are best illustrated in the accompanying graphs. These show the production per man-shift and incentive pay earned per man-shift for the years 1947 and 1948, each plotted against the major variant, stoping width.

An indirect result and one that helped effect the improved output was the focusing of the shift bosses' attention on production delays and their elimination. This was brought about by not including such delays in the incentive rate, so that they would be reported separately and straight day wages paid. Concurrently, a supervisors' conference program on line responsibilities and authorities aided in the development of "cost-consciousness" throughout the organization.

Other underground piece-rates that have been revised to bring them into line with the incentive policy already outlined are those for diamond drilling for exploration, development drifting and crosscutting, and special stoping opera-

tions. Each of these operations has shown satisfactory improvement for the company and for the wage-earner.

Administering the Rates

The process of administering the underground incentive rates is a function of the Mine Department. All piece rates, production measurements and earning statements must have the approval of the mine superintendent before payment is made. The Survey Department and Cost Department do the work of measuring production and compiling time and explosives records for the incentive plans.

All incentive "contracts" for stopes, development drifts and raises, timbering of backstopes, and diamond drilling run for a period of four weeks. This is in accordance with the 13-period company year. Work done is measured by survey at the end of each period, and width, distance and other details are noted. Tonnage and footage calculations are made for stope breaking, mucking and filling, mill holes cribbed, drifting and raising advance and slash, and holes drilled by diamond drill. Pieces of stope sill timber placed are also checked for size and number.

Each crew (two or more men) receives a statement of its incentive earnings for the period. Credits are detailed on the sheet according to the work done and rate paid, as are labor and explosives charges. The net earnings are shown divided among the crew, depending on the number of hours worked by each crew member. A typical stope statement is reproduced opposite.

Crews are allowed two days in which to register any disagreement with the figures on their statements. Despite the many checks carried out before the sheets are issued, re-surveys are often made at the request of the crews, through their shift bosses. Following the two days for complaints, the statements are finalized and sent to the Cost Department for inclusion in the fortnightly payroll. Stope balances of broken ore not yet mucked, etc., are kept by the surveyors for payment on the succeeding period's incentive statements.

Other Work Stimulated

The incentive plans for stoping, level development, sill timbering, and diamond drilling cover the larger part of the "contract" work at the Hollinger. Other operations that carry opportunities for extra earnings are underground sampling, timber framing, trolley-wire box erection, ladder making, and the recent fabrication of Noranda-type lockers for an addition to the change-house.

This fabrication of the lockers provided an excellent opportunity for trying an unusual diversion from the familiar piece-rate plans. It was decided to make the 1,750 lockers required in the company's own plate shops, using time standards set by time study. Incentive rates were set at so much time per piece. Each plate worker's daily production of pieces was then multiplied by the time standard, which gave his production in "standard hours." His base hourly rate then determined his total pay for the day, and the relation between standard hours produced and actual hours worked gave a measure of his efficiency. The 15 men who participated made an average of 133% of base wages in total earnings. Cost of the whole operation, including material, was appreciably less than the original estimate.

The application of both piece-rate and standard-hour plans may be expanded in the future to cover some production and maintenance operations not yet included. The feasibility depends to a great degree on the practical measurement of output and the difficulty of relating the worker's time and effort to units of production. It has been found that a grossly inequitable incentive scheme can do more damage to the morale of an organization than would be done by having no wage incentive at all.

Scraper Mucking Rates, Cut-and-Fill Stopes

(Part of schedule is shown)

MUCKING—SCRAPER STOPES

CLASS 1 UNITS (15 Hp. and Over) Distance From Mill Hole, Ft.	Cents Per Ton
0— 61	17
60— 80	18
80—100	19
100—120	20
Each additional 20 ft.	1
First lift through lagging	
0—60 ft.	28
Each additional 20 ft.	1
Double scraping	Add 6 cents per ton

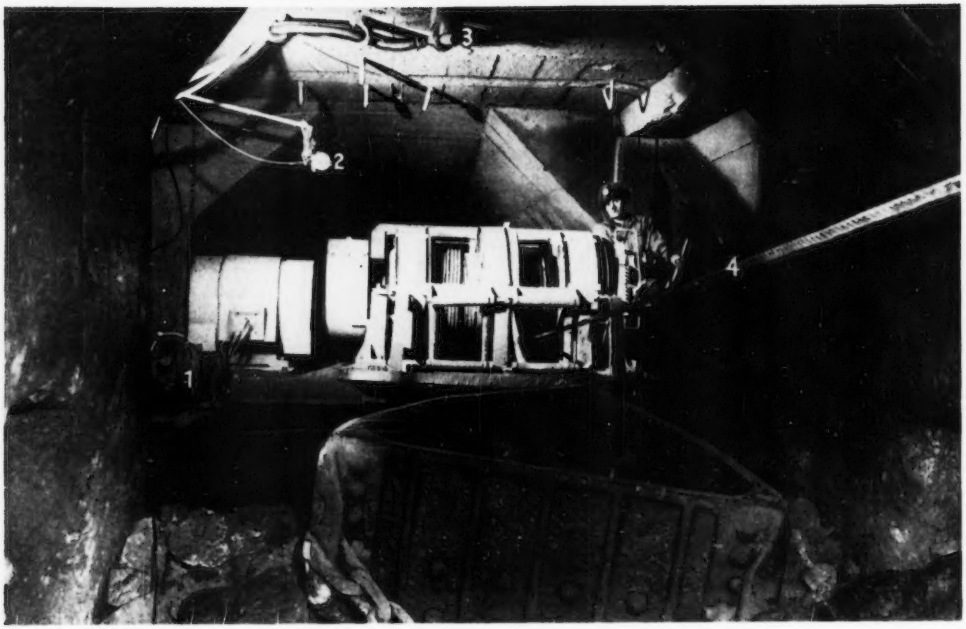
CLASS 2 UNITS (Under 15 Hp.) Distance From Mill Hole, Ft.	Cents Per Ton
0—20	17
20—40	18
40—60	19
60—70	20
Each additional 10 ft.	1
First lift through lagging	
0—20 ft.	28
20—40 ft.	29
40—60	30
Each additional 10 ft.	1
Double scraping	Add 6 cents per ton

Non-financial Incentives

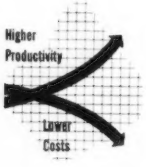
Direct wage incentives have been dealt with so far. The simplest definition of "incentive" is often given as an *urge* to do something, or not to do it. Wages form only the most *tangible* of many industrial incentives. The belief that they form the most *effective* is often a subject for wide discussion in current industrial thinking. Elements bearing on the individual worker's output or "job satisfaction" are frequently listed in the results of nation-wide or industry-wide polls, both in the United States and Canada, and wage conditions usually rank third, fourth or even fifth. Ahead of them in these polls are elements variously described as "recognition by supervisors," "physical working conditions" or "friendly atmosphere."

These intangibles have always been realized in some degree by Hollinger as important factors in morale and individual output. Recently, increased emphasis has been put on the part that top management plays in developing and maintaining a high level of morale at all levels of the organization. More consideration has been given in recent years to the company's integral organizational set-up, work planning and coordination, community relations, and general management policies and procedures than at any time in the past.

Such attention to the separate phases of what is termed "scientific management" has resulted in considerably improved morale and individual output. Equitable wage incentives form one of the major phases.

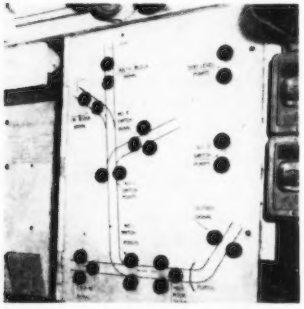


SAFETY AND PRODUCTIVITY exemplified in this scraper set-up at Climax. Note: 1, air hoist to run out cables, saving time and possible injury; 2, spotlight to light drift, increase output; 3, "bazooka" air-water nozzle to clear dust; 4, non-elastic cable to avoid whipping back on operator if cable breaks. Excellent ventilation of the mine workings is also provided.



A Safety Program Can

W. E. JONES
Personnel Manager
Climax Molybdenum Co.
Climax, Colo.



SPEED WITH SAFETY in haulage is assured at Climax by controls like this signal panel in mine despatcher's office. Through the tunnel 48 trains move per shift.

MINING COMPANIES are becoming increasingly aware that a safety program can be justifiable on financial grounds, as well as with respect to humanitarian considerations and improvement in employee and public relations. Many of these employers can support this view from actual experience.

Climax Molybdenum's experience with its safety program is not markedly different from that of many other companies. Nevertheless, the financial aspects of some of the results obtained should be of interest.

The foundation for the company's present safety activities was laid in 1937 and 1938, when a full-time safety program was organized. Today considerable information is available on procedures by which safety can earn its way financially.

Safety, production and efficiency are so closely related that it is difficult to distinguish between them. Any proposed safety measure should not only solve the problem involved with respect to safety but also offer a reasonably good chance of improving efficiency and increasing output. If it does not, the matter is studied further until a safe and practical solution is reached. It is this concept of safety held by Climax that, among other factors, is responsible for some of the savings made.

An example of this practical approach is seen in the way the management handled the problem of cleaning out the rock and fines left in the 10-ton Granby-type cars after dumping. During the winter, when wet ore was being handled, it was not uncommon to find as much as 2 tons of ore remaining in some of them. Several methods were tried in an effort to overcome this condition. At one time 10 men with jackhammers, moils and dynamite were used. On an average it took them 30 min. to clean a 20-car train, at which rate each car could be cleaned only twice a shift. Several near accidents arising from the use of dynamite, from damage to cars by blasting, and from the large

State Compensation Insurance Fund Statistics

Year	Payroll	Premium Paid	Average Plant Rate	Dividend Received %	Dividend Received Amount	Net Premium	Net Average Plant Rate
1938	$2,124,040.01	$ 88,209.80	$4.153	25.0	$22,052.45	$ 66,157.35	$3.115
1939	1,566,327.35	37,995.01	2.426	30.0	11,398.50	26,596.51	1.698
1940	1,798,704.87	45,080.06	2.506	35.0	15,778.02	29,302.04	1.629
1941	2,189,318.91	49,617.24	2.266	30.0	14,885.17	34,732.07	1.586
1942	3,255,996.66	47,389.56	1.456	30.0	14,216.87	33,172.69	1.019
1943	3,365,795.35	33,547.78	0.997	20.0	6,709.56	26,838.22	0.797
1944	1,732,867.03	17,142.47	0.989	20.0	3,428.49	13,713.98	0.791
1945	1,162,210.67	11,311.02	0.973	20.0	2,262.20	9,048.82	0.779
1946	1,150,407.16	9,025.22	0.784	25.0	2,256.00	6,769.22	0.582
1947	1,454,041.22	11,732.25	0.807	25.0	2,934.00	8,798.25	0.605
		$351,050.41			$95,921.26	$255,129.15	

Experience Rating became effective 7/1/38. Experience Rating was dropped 12/31/47.

Compensation Insurance Cost Per Ton of Ore Mined

Year	Net Premium	Tonnage	Cost/Ton	Employees' Base Pay
1938	$66,157.35	4,286,861	$0.0154	$5.25
1939	26,596.51	3,464,489	0.0077	5.25
1940	29,302.04	3,850,318	0.0076	5.75
1941	34,732.07	4,766,534	0.0073	6.50
1942	33,172.69	6,116,330	0.0054	7.00
1943	26,838.22	6,397,960	0.0042	7.00
1944	13,713.98	3,413,492	0.0040	7.00
1945	9,048.82	2,765,502	0.0033	7.00
1946	6,769.22	1,731,574	0.0039	7.00
1947	8,769.25	1,953,578	0.0045	8.48

Compensation Insurance Cost Per Employee

Year	Net Premium	Average Number of Employees	Cost Per Employee
1938	$66,157.35	1,077	$61.43
1939	26,596.51	857	31.03
1940	29,302.04	839	34.93
1941	34,732.07	1,007	34.49
1942	33,172.69	1,295	25.62
1943	26,838.22	1,187	22.61
1944	13,713.98	648	21.16
1945	9,048.82	409	22.12
1946	6,769.22	461	14.68
1947	8,769.25	543	16.15

Also Curb Costs

number of men required, the insufficient cleaning of cars, and haulage delays made this method unsuitable. After much study the system now used was adopted. It eliminated the objectionable features mentioned. Under it, a crew of two men loosen the ore left in the bottom of a car with an air-operated push-type rake while the car is in dumping position. A train of 20 cars is cleaned in 4 min. At the mine base wage rate of $10.44 per shift in effect at the present time, a savings in wages alone of approximately $800 per week on a two-shift basis has been made. This figure does not include indirect savings difficult to evaluate accurately.

This approach to safety problems has also brought into use other devices and methods that originated in safety suggestions and that in many cases have increased efficiency and improved output. Some of the more important are the concreting of slusher drifts, a mechanics' cable truck, hydraulic cable cutters, reflectorized signs in the haulage system, a dispatcher's interlocking switchboard, derailers, mechanical means of handling material, folding scrapers for slusher drifts, sealed-beam spotlights for slusher drifts, and automatic ventilation doors controlled by electric eyes.

Three Yardsticks

Compensation insurance costs are another yardstick for measuring in dollars and cents some of the benefits possible from a well-balanced, successful safety program. An accompanying table shows the gradual decrease in the net average plant rate during the 10-year period from 1938 to 1947, as well as the amount of dividends received. This rate in 1947 was only about 20% of what it was in 1938. As is to be expected, the decrease roughly parallels the drop in frequency and severity rates experienced during the same period. This insurance is carried with the State Compensation Insurance Fund under an ex-medical plan. The rates are expressed in dollars of premium per $100 of payroll.

The cost of compensation insurance per ton mined is another method of comparison. A tabulation is included to show that during the 10-year period wages generally increased while the cost of insurance per ton of ore mined generally decreased.

The average cost of compensation insurance per employee is also indicative of the improvement possible and a separate tabulation gives this information.

Minor Accidents May Also Be Expensive

Sometimes it is surprising to discover that it is possible for the costs of minor accidents to exceed occasionally those of lost-time accidents during a year. The Industrial Commission of Colorado has published a Medical and Surgical Fee Schedule. The fees given represent a reasonable minimum for the services in question. Fees higher than those shown may be charged if the situation warrants. On the basis of the fees quoted, the cost of only the "Medical & Surgical" care of minor accidents will be about $8,000 for the Climax company in 1949. The average hospital cost of each minor accident that has required an employee to report to the hospital during the first seven months of 1949 is $12. This includes no indirect costs, such as damage to equipment, time lost by fellow employees and supervisor, and delays to production, as well as many others. Such indirect costs would add materially to the cost of minor accidents as well as to those that involve lost time, and are costs that must be borne by the employer. This indicates that the prevention of minor accidents should receive the same thorough attention that is given to lost-time accidents if this source of costs of accidents is to be improved. Company management and safety engineers are becoming increasingly aware of the importance of this factor.

The financial benefits to be obtained from a carefully organized safety program will vary with the local conditions. The costs of accidents will also vary for the same reason. However, there are some real and tangible savings that can be made regardless of the variables. When safety measures are designed to improve production and efficiency also, as they are at Climax, these benefits will begin to appear.

Changing Practice Favors

A. H. HUBBELL
Managing Editor

EARLIER THIS YEAR a well-known mining man surveyed a number of companies representing a cross section of the industry in the Eastern, Central and Western States to secure data on their respective costs of mining. Generalizing from the facts obtained, he said recently that the companies that had concentrated on mechanization showed a *lesser* cost increase percentagewise over 1939 than those that had not mechanized as intensively.

In almost similar vein, an iron-mining executive, who supervises a number of open pits, says: "We mechanize in the hope of staying even, to keep things from getting worse." Costs are higher, however, than they were a year ago, he says, adding that the prevailing higher price of ore had saved the day.

From this one can only infer how much higher the costs might hava risen had the effort to lower them not been made.

Cost improvement is a normal day-to-day objective of any competent management. Today it demands attention. Wide inquiry among operators discloses varied measures devised to get the costs of unit operations down. Factors affecting cost improvement are referred to in the article on pages 80 and 81. Some of the measures are touched on briefly in this article. Others are discussed at greater length in other articles in this issue. As indicated in *E&MJ's* surveys, certain unit operations, such as drilling and blasting, exhibit more rapid and varied change than others. These changes are usually inspired by the need for lower costs.

Chance Is Good to Lower Drilling Costs. All phases of the evolution of blast-hole drilling practice since, say, 1931, are still to be seen in operation somewhere. These comprise the use of ordinary sharpened carbon steel; of alloy-steel rods with bit forged on the end; of competitive makes of detachable steel bits of the multiple-use type and the single-use type; of rock drills using jointed rods and detachable steel bits for long-hole work; of diamond drills with bits that themselves have also undergone an evolution; of tungsten-carbide-tipped drill steel with forged bits, now finding a widening use with light machines; of tungsten-carbide-tipped detachable bits with both light and heavy machines, in both short-hole and long-hole work, and with carbon-steel rods and alloy-steel rods. All these types of equipment are to be found in use. All (save the first) compete for possible adoption with a view to bettering drilling costs, as conditions vary that affect performance.

As with the drill, the rod and the bit, so with the handling of the equipment. Pneumatic columns, the ratchet column bar, air-operated jack legs, and various types of jumbos, both crack-mounted and crawler-mounted, large and small, have been developed for easing and speeding the drilling of almost any drift round and many stope rounds and lowering the cost of the work. Accompanying these cost-cutting developments has been the provision of long-feed mountings that permit correspondingly long changes of the steel, cutting down the time required for changing it.

Never before in mining work has such a variety of equipment and practice been available for blast-hole drilling. It affords the operator, who finds his drilling costs unsatisfactory, a good opportunity to better them. The written record of the results of experimentation and testing with various combinations of this equipment is extensive in the pages of *E&MJ* and elsewhere in technical literature. The reader is referred to the article by Mr. Neyman on pages 90 and 91 of this issue. In addition, the following notes may be of interest:

Some Case Studies.[1] An eastern zinc mine, in driving development headings, has cut its cost for labor and explosives from $7.46 to $6.57 per foot. Two procedures are used: (1) A driller, with one jumbo and locomotive, drills and shoots a 6-ft. heading in 8 hr. The jumbo has two 3-in. machines with hydro jibs; a 6-ft. sash, and automatic feeds. On the intermediate shift, one man with a locomotive, a trip of cars, and a loader mucks out in 8 hr. (2) Two drillers with a jumbo (same as before), a locomotive, and a trip of cars, drill and shoot the 6-ft. heading in 8 hr. No. 1 is preferred, safety permitting, because the men are not rushed to complete the cycle and, as a result, never work overtime.

The same operator has made extensive tests with carbide bits in development work. A 3-in. bit is used to drill a two-hole cut (in dolomitic limestone) instead of a burn cut of four 1¾-in. holes. The round is broken to the two 3-in. holes, saving roughly $1 worth of explosives per heading. Present bit costs demand that each bit drill the cut for 20 headings to break even. A reduction in the price of bit would make this standard practice. Carbide bits for other holes in the drift headings do not pay in the dolomite limestone, save where it is very hard, due to silicification.

New Park, in Utah, is pulling a round daily in hard diorite porphyry, using eight carbide bits and two drills, as against taking twice the time for drilling the round formerly, using 12 to 14 racks of steel bits.

Results of a survey (*E&MJ*, Oct., 1949, p. 97), made to determine the extent to which diamond drills are being supplanted by rock drills and carbide bits for drilling long holes, shows that some important companies, notably Howe Sound at its Holden mine, find that the latter practice has cost-cutting advantages under their conditions. At Holden, percussion drills and 2-in. carbide-insert bits have completely replaced diamond drills for blast holes. Results on a total of 61,389 ft. drilled, using 577 bits, from the start of drilling in 1948 up to mid-June last, indicate that the cost per foot for percussion drill holes up to 70 ft. in length is roughly one-third of that for similar diamond-drill holes.

Powell Rouyn, Quebec gold producer, expects to lower bit costs materially in this way and to cut labor costs about 40%; and Pamour Porcupine, in Ontario, anticipates making a considerable saving in cost per foot of hole drilled.

[1]For other cases, see articles on pages 95 and 96-99.

Reduction of Breaking Cost

Diamond drilling of blast holes nevertheless remains strongly entrenched in many places, as shown in the survey mentioned.

Tipped, Forged Steel Found Cheaper. A cost saving is claimed for the use of carbide-tipped forged alloy steel in various lengths, reported in *E&MJ* for August, page 80, as being in service in the Bishop area, California. Steel of similar sort with the forged bits carbide-tipped is said to be in use elsewhere also, especially in the Birmingham district, where it is under extensive test. This steel, by having the bit integral with the rod, apparently gets around the problem involved in connecting the bit to the rod, which has given trouble at times with detachable bits. The development suggests a return to old-fashioned forged steel, which had to be carried in its several lengths to the working place. However, a set of three or four lengths for the different changes appears to be adequate for drilling a round. The Tungstar Corporation at Bishop, a user, claims an important saving, plus many advantages, derived from use of this steel, as compared with the conventional detachable steel bits it formerly used.

Claims Are Made for Single-Pass Bit. Some operators report that the single-pass steel bit gives better drilling costs than the multiple-use steel bit. Bunker Hill & Sullivan at the Mining Congress meeting in Spokane in September discussed its experience with a bit of this type in a paper by R. S. Hooper. The new bit increased drilling speed, lowered the bit cost, and saved explosives because of the smaller hole. The data are: Single-pass bit, 12.4 ft. of hole per use and 1.21c. per ft. of hole drilled. In comparison, the detachable steel bit gave 2.5 ft. of hole per use and a cost of 5.5c. per ft. of hole drilled; and carbide bits 149.5 ft. of hole per use with a cost of 8c. per foot of hole drilled.

A second Coeur d'Alene operator also, who has switched to the single-pass type from the conventional threaded bit, obtained a cost of 2½c. per ft. of hole with the throwaway-type bit against 8½c. for the old bit, this in the first quarter of this year. In these tests, 4,300 bits were experimented with in 12 different working places to give the low cost cited.

Another large company, when drilling formerly with a multiple-use bit, employed 22 men to make up, recondition, straighten drill rods and grind about 4,000 of the bits per day. When it changed to a single-pass bit, it required only 10 men, at $8 per shift, to make up and recondition the rods. This, it holds, was on the conservative side.

Other instances where drilling costs have been cut are described in articles on pages 90, 91, and 95 of this issue.

Blasting for Less Money. Three things determine the point of maximum economy for drilling and blasting. They are (1) the drilling speed and the cost per foot of hole, (2) the amount of powder used, and (3) the degree of fragmentation and other results such as the degree of shock experienced in the workings and on surface.

Reduction in blasting cost is being achieved in many places through use of short-period, or milli-second, electric-delay blasting caps. Advantages include improved fragmentation, this calling for less secondary blasting; also minimized back-break, and reduction of vibration.

At the Mt. Hope iron mine (Warren Foundry & Pipe Corp.), New Jersey, short-period delays in the 4-ft. delay series have been used for over a year in every type of operation. Greatest improvement is shown in primary blasting in shrinkage stopes, where the blockiness of the ore, as previously broken, had given trouble. The secondary blasting has been cut 30-40% and the overbreak is less. These delays permit use of longer holes, spaced as desired, without regard to the possibility of cut-off or missed holes.

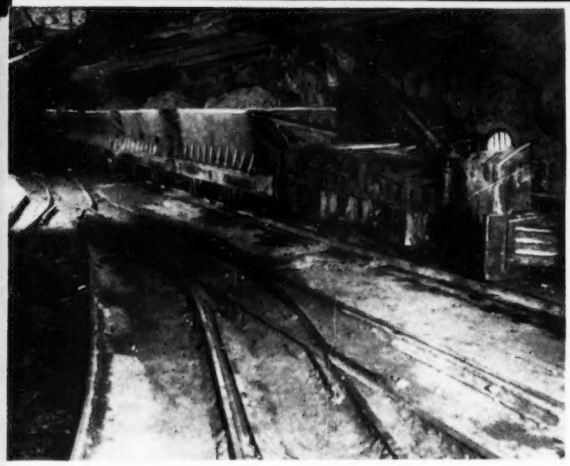
In its use of fast-delay caps, a large Canadian company has tried them in all types of work, including diamond-drill blast-hole stopes. Periods of 25 to 40 milli-seconds have proved most advantageous. They have given best results in opening slots where narrow faces had to be blasted. Several rings are blasted at once. With instantaneous caps the third line of holes does not break. If conventional delay caps are employed, the front holes will tear out part of the next holes. With use of the fast delays, however, the proper relief effect is retained and adjacent holes are not disrupted. The split-second timing must be determined closely. For example, 50 milli-seconds has been found to be too slow.

At the Balmat zinc mine, New York, fast delays have been found to prevent hole robbing in stope work, eliminating the chance of getting the powder of cut-out holes in muck piles, and to give much better fragmentation.

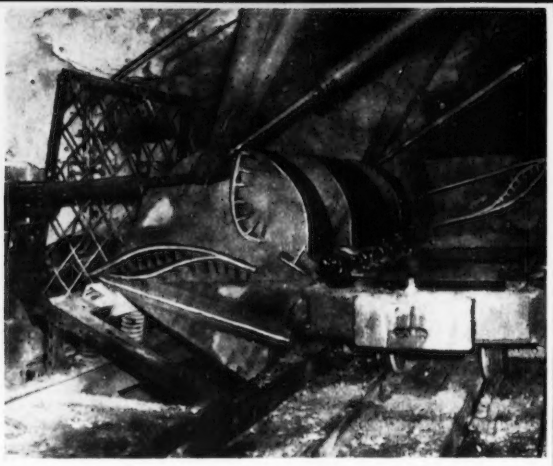
Improved fragmentation and reduced vibration are also being obtained with use of the blasting timing machine. New York Trap Rock Corp. has developed a rotational switch for its blasting, using a delay period of 0.020 to 0.030 sec. between successive holes. The resultant improved fragmentation has cut secondary drilling in half and reduced the amount of powder required.

Breaking Costs Lowered in Salt Mining. A salt producer with underground mines in Kansas and Louisiana, the Carey Salt Co., Hutchinson, Kan., has done much to get better drilling and blasting costs, says S. B. Horrell, vice president. With others, his company had long used the drill post, putting in three sets of holes from one setting. This caused rather difficult blasting to get the desired breakage. Use of a three-drill jumbo has made it possible to employ heavier, faster machines, drilling more holes per unit of time, thereby lessening labor and cutting the drilling costs.

Use of the jumbo has also made it possible to space the drill holes accurately, so as to give best results in blasting. This, with the use of fast-delay caps, has improved the blasting costs. Not only do the delay exploders produce better fragmentation, incidentally cutting the cost of subsequent handling, but the timed spacing relieves the different sections of the face at different moments so that the blasting is more effective. Complete and uniform detonation is also obtained, whereas formerly many unburned sticks of powder would be found when mucking. Blasting, moreover, takes less time than formerly, it being possible to fire 150 shots in about 10 minutes. Firing is done from the 440-volt power line. An accurate check is made of the results of each shot.

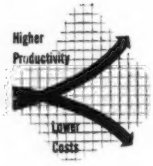


ORE TRAIN from Star workings en route to pocket at Hecla shaft. Car design cuts maintenance, makes higher speeds safe.



DUMPING CARLOAD of ore from Star workings at Hecla pocket. As body hits bumpers, sticky muck is jarred loose, emptying car.

Cost Cutting at Star Mine Helped by Many Factors



R. W. NEYMAN

General Superintendent
Hecla Mining Co.
Wallace, Idaho

TEN FACTORS have contributed to making possible a reduction of almost 30% in drilling and blasting costs in the Sullivan Mining Co.'s Star mine at Wallace, Idaho. In brief they are:

1. Processing and dispensing bits underground.
2. Use of smaller diameter bits.
3. The use of smaller rod section, giving less steel loss per bit used and a cheaper rod-repair labor cost.
4. Increased footage per bit used.
5. Reduction of air transmission loss.
6. Higher air pressure at point of use.
7. Less air consumption per foot of hole drilled through use of smaller machines.
8. Reduction of man-hours spent on drill repair, as well as the amount of replacement parts required.
9. Changing powder handling schedules to reduce labor cost.
10. Reduction in pounds of powder per ton due to smaller size holes.

This reduction in costs is demonstrated by comparing the figures for 1945 with those for the first half of 1949. The figures are given in the accompanying table. The actual reduction for drilling and blasting, including bits and rods, compressed air, drills and drill repairs, and explosives, is from 70.4c. per ton to 49.4c. per ton, a decrease of 29.8%. If the present prices for labor and supplies were diminished in the calculation to conform to those existing in 1945, the cost of the first half of this year would be still lower, or 37.2c. per ton for these phases of the operation, as compared to 70.4c. in 1945, or a total reduction of 47.1%.

The Factors at Work

How did the factors that have been cited operate to bring costs down? The following comment on the analysis in Table I will make this clear:

1. Bits. In 1945, the detachable steel bits used were reconditioned by outside shops. In 1949 they were ground underground; hence the increase in labor costs over 1945 with corresponding decrease in supplies.

2. Rods. In 1945, practically all steel used was 1¼-in. round. In 1949 all steel was 1-in. hexagonal section. Threads are now cut for Type A-O bits in a Toledo threader. In 1945 Type 1 threads were forged. Forging and tempering was done in open coke furnaces in 1945, but is now done with a heat-controlled oil furnace.

3. Compressed Air. In 1945, compressed air was all produced on surface and supplied to the mine through 11,000 ft. of 6-in. line. At present, approximately half of the air is supplied with a semi-automatic compressor underground which pumps into a 75,000-cu.ft. chamber (500,000 cu.ft. free air). This has made it possible to maintain high air pressure over the peak periods and at the same time it has reduced power consumption 20% through lowering the frictional losses in air transmission.

4. Drills and Repairs. Since changing from 1¼-in. round steel and Type 1 bits to 1-in. hexagonal steel and Type A-O bits, all 3½-in. piston machines have been replaced with 3-in. piston machines. This accounts for a substantial

Table 1. Analysis of Drilling and Blasting Costs Per Ton, Sullivan Mining Co.

	1. BITS		2. RODS		3. COMPRESSED AIR			4. DRILLS & REPAIRS		5. EXPLOSIVES		TOTAL
	Labor	Supplies	Labor	Supplies	Labor	Supplies	Power	Labor	Supplies	Labor	Supplies	
Year of 1945	$0.0146	$0.0762	$0.0384	$0.0585	$0.1105	$0.0208	$0.0531	$0.0191	$0.1702	$0.0132	$0.1294	$0.7040
First Half of 1949	0.0397	0.0397	0.0234	0.0097	0.0642	0.0172	0.0422	0.0213	0.0876	0.0094	0.1396	0.4940
1949 Based on 1945 Prices	0.0288	0.0319	0.0170	0.0050	0.0466	0.0138	0.0422	0.0155	0.0571	0.0068	0.1074	0.3721
Percentage—1945	15.95	84.05	39.64	60.36	59.94	11.29	28.77	10.09	89.91	9.25	90.75	
Percentage—1949	49.89	50.01	70.52	29.48	51.89	13.91	34.20	19.54	80.46	5.21	94.79	
Percentage Change (Actual)	+171.9	—47.9	—39.1	—83.4	41.9	—17.3	—20.5	+11.5	—48.5	—28.7	+ 7.9	—29.8
Percentage Change —Based on 1945 Prices	+ 48.6	—58.1	—55.7	—91.5	58.8	—33.6	—20.5	—18.8	—66.5	—48.5	—17.0	—47.1
Percentage Change Overall	—33.1		—77.3		—44.4			—61.6		—19.9		—47.1
Price Increase, 1945 to 1949 (Percentage of)	37.7	24.4	37.7	19.4	37.7	24.6	00.0	37.7	53.4	37.7	30.0	32.8

saving of compressed air and a remarkable reduction in drill repair costs. Repair costs on the 3½-in. power-feed machines, while they were used, were almost five times as high per foot of hole as for the 3-in. power-feed machines and the stopers.

5. **Explosives.** Actual explosives consumption per ton of ore produced in stopes has been reduced 17%. In the meantime, the price of explosives has increased 30%. Decrease in handling costs (labor) is accounted for partly by decreased volume, but principally by a change that has been made in handling methods.

Improved Dumping Facilities Cut Transport Costs

Another interesting comparison of costs is that given in Table 2. Here the per-ton costs of hauling ore from the Star mine through the 4,000-ft. level to the Hecla shaft pocket are compared for 1945 and for the first half of 1949. A total reduction of 5.17 cents per ton is shown, including labor, supplies and power. It is also shown that the cost of 21.66 cents per ton for the first six months of 1949 would have been an additional 5.34 cents lower had prices of labor and supplies been what they were in 1945.

Here the cost reduction effected followed on the installation of a new car-and-dump system at the Hecla shaft pocket which made possible the quick dumping and handling of the ore trains hauled from the Star workings. Stickiness of the muck had previously made this operation difficult. The new dumping system allowed the car bed to be dumped while the trucks remained stationary on the tracks. As the car is dumped, the body hits bumpers, the resulting shock helping to remove the sticky muck.

Table 2. Comparison of Costs of Transporting Ore from Star Mine to Hecla Shaft Pocket

	Labor	Supplies	Power	Total
1945—Cost Per Ton	$0.2037	$0.0385	$0.0261	$0.2683
1949—Cost Per Ton, First Six Months	0.1809	0.0196	0.0161	0.2166
1949—Based on 1945 Prices	0.1314	0.0157	0.0161	0.1632
Percentage of Total, 1945	75.92	14.34	9.174	100.00
Percentage of Total, 1949	83.52	9.07	7.41	100.00
Percentage Decrease	11.2	49.1	38.3	19.3
Percentage Decrease Based on 1945 Prices	35.5	59.2	38.3	39.2
Percentage Price Increase	37.7	25.0	00.0	32.7

The type of car used has shown the following advantages:

1. Tons per car has been increased.

2. The center of gravity of the loaded car is very low, thus reducing track maintenance and making higher haulage speeds safer than before.

3. The car remains stationary while being dumped, whereas the former cars had to be bumped back and forth. This caused considerable damage to the electric locomotive as well as to the bumpers, bumper springs and the car itself.

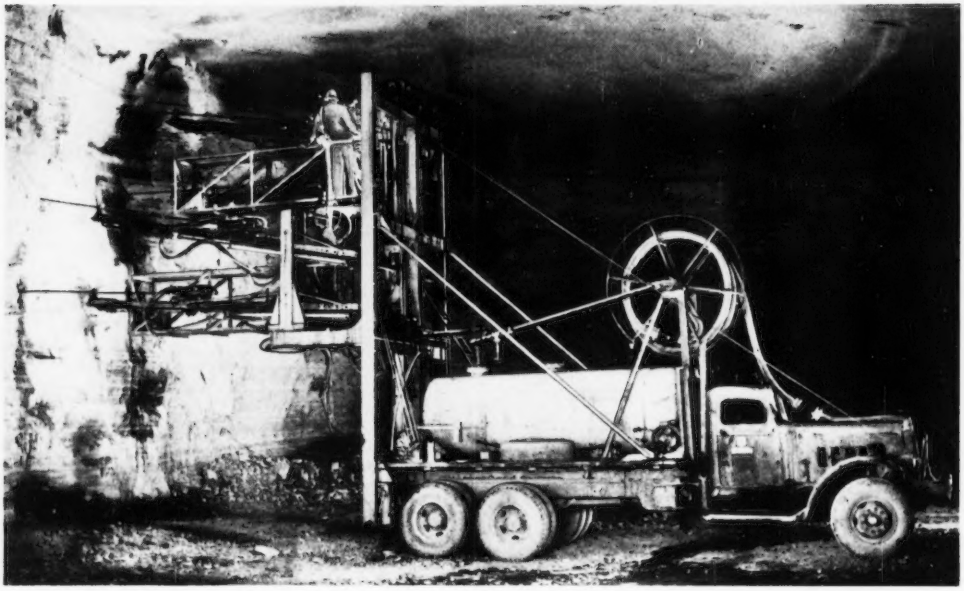
4. Power requirements for making this haul were lowered considerably.

5. Tons hauled per train, per shift and per man-shift were increased considerably.

Output Per Man-Shift Raised 30% in Stopes

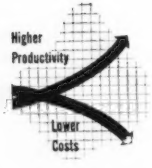
While no extensive changes have been made for some years in stoping methods at the Star, the company has increased its production per man-shift in stopes by over 30%, beginning in 1942, by adopting scrapers, or slushers, for mucking in stopes in place of mucking by hand into stope cars. Previously, in the cut-and-fill method used, the ore, after being shot back on to the floor, was mucked through the floor into 22-cu.ft. cars on the floor below. These were hand-trammed to the chute. Inasmuch as the rate of advance was relatively slow for this type of mining, it was necessary to install track bents on the tram floor to raise the track about 2 ft. above the caps, and to fill in with gob under the bents to protect the caps below from ground squeeze until the floor above was mined out and the track floor gobbed.

Installation of slusher hoists has increased the rate of advance so much that it is no longer necessary to fill over the caps below to protect them, and the muck can be scraped across the original floor placed on the caps and the whole floor gobbed behind as the brow advances on the floor above. In the former method, no work could be done in the face until all the ore from the round was trammed to the chute. In the present method, the muck can be dropped through the floor onto the floor below and the slushing proceeds while drilling is carried on on the floor above, thus causing the operations to overlap and cutting down the time of the cycle.



TWO-MAN JUMBO, mounting total of four 4-in. rock drills on two movable platforms, drills 76 15-ft. holes in 27x60-ft. heading in 6 hr. Round breaks 1,500 tons. See also the jumbo shown on page 94. This and other photos by United States Bureau of Mines.

Unique Equipment Helps in Cutting Shale Mining Costs

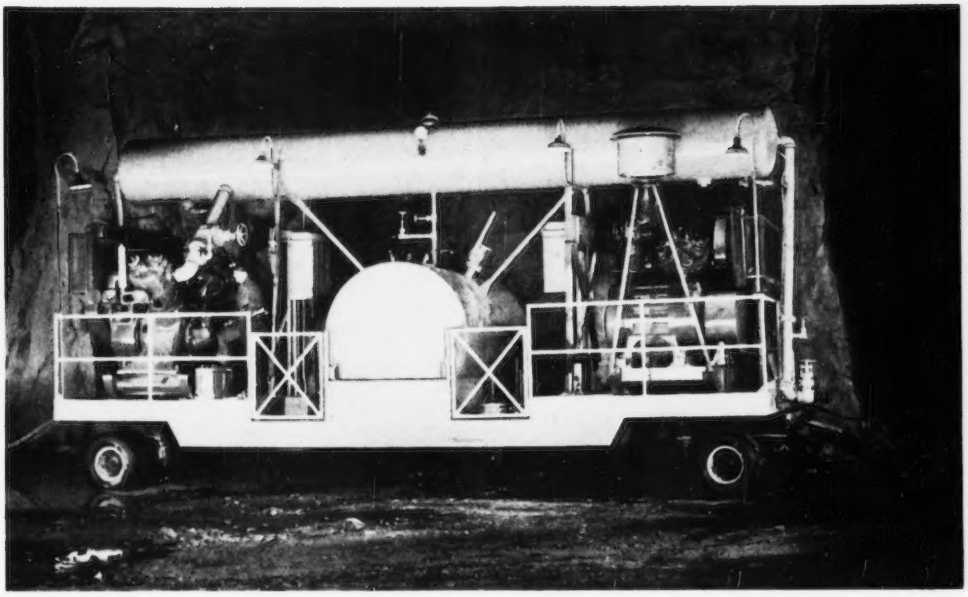


E. D. GARDNER
Chief, Oil Shale Mining Branch
Bureau of Mines
Denver, Colo.

FOR AN OIL-SHALE ENTERPRISE to be successful, an unusually low mining cost will be necessary. Methods and practices at the U. S. Bureau of Mines oil-shale experimental mine, Rifle, Colo., were designed with a cost goal in view. The oil shale is a strong, tough marlstone that stands safely unsupported over relatively wide spans; the beds lie nearly horizontal. A measure 70 ft. thick will be mined in three levels, with the advance heading 27 ft. high at the top. Pillars are 60 ft. square, spaced 60 ft. apart.

A standard 3-cu.yd. electric shovel was selected as the loading unit; three 15-ton diesel trucks are used for haulage. The estimated capacity of the shovel was 1,500 tons per 8-hr. shift. The problem, therefore, was to develop a round to break 1,500 tons in a 27x60-ft. heading, as well as a procedure for drilling the round in one shift. Further, it was desired to drill the side holes parallel to the ribs, and the top holes parallel to the roof stone. A new type of jumbo has been designed and has proved very satisfactory. It mounts four 4-in. air-driven percussion-type rock drills and is operated by two men. A round comprises seventy-six 15-ft. holes and breaks 1,500 tons; it is drilled in six hours. The design of the jumbo permits accurate alignment of the drill holes. Each hole is drilled with a single drill rod and one bit with tungsten-carbide inserts. The diameter of the holes is 2 in.; the holes are charged with $1\frac{3}{4}$-in. explosive without tamping. In charging the holes, the blasters use a platform hoist mounted on a tractor. A similar machine is used for scaling.

A 20-day test run on the top level was completed in May, 1949. A total of 29,835 tons was mined with 322 shifts worked; this included maintenance and direct supervision. One hundred eleven tons was produced per man-shift underground,

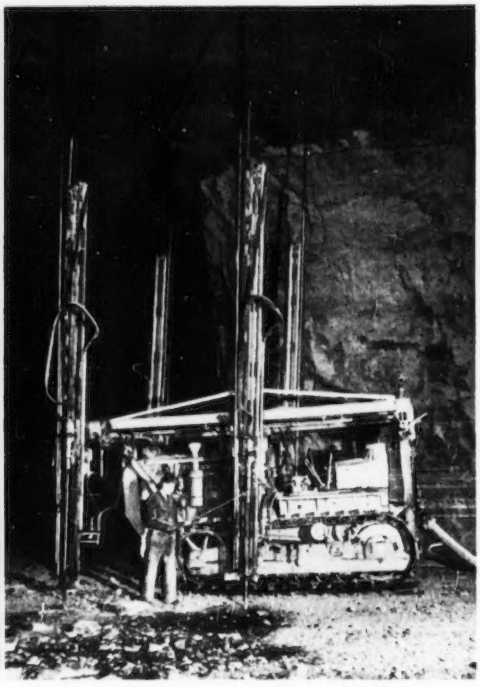


COMPRESSED AIR and water for rock drills on jumbo are supplied from this 30x12-ft. portable utility unit, assembled on a 30-ton trailer as base. Its equipment for compressing air comprises two 770-cfm. compressors and a 200-cu. ft. receiver.

LOADING of drill holes is speeded by use of this portable unit which is patterned after a fork-lift truck. Men, explosives and tools are elevated to any required position.

FOR BARRING DOWN loose rock from face or back, after blasting, this specially-designed portable scaling rig is used. Two men can work at a time on the adjustable elevated platform.

LOADING OF SHALE, after blasting, is done with this 3-cu.yd. electric shovel into three 15-ton heavy-duty rear-dump trucks.



BENCH LEVEL will be drilled with this jumbo. It mounts four 4-in. percussion-type air drills, each having a 15-ft. feed.

Costs Summary, Test Run No. 2—Dollars Per Ton

	Operation Labor	Maintenance Labor	Power	Fuel	Explosives	Bits & Drill Steel	Other	Total
Drilling	$0.020	$0.008	$0.006	....	....	$0.023	$0.011	$0.068
Blasting	0.021	....	....	....	$0.091	....	....	0.112
Loading	0.019	0.005	0.003	$0.003	....	....	0.001	0.031
Transportation	0.026	0.002	....	0.005	....	....	0.007	0.040
Scaling	0.015	0.002	....	....	....	....	....	0.017
Supervising and Engineering	0.017	....	....	....	....	....	....	0.017
Labor Burden	0.023	....	....	....	....	....	....	0.023
Miscellaneous	0.004	....	0.002	....	....	....	0.015	0.021
TOTAL	$0.145	$0.017	$0.011	$0.008	$0.091	$0.023	$0.034	$0.329

and 92.7 tons per man in total direct force. The loads averaged 17.1 tons; 0.71 ft. of hole was drilled, and 0.476 lb. of Gelex No. 2 explosive used per ton of shale broken. An average of 530 ft. was drilled per drill rod and 1,766 ft. per drill bit.

The direct mining cost is shown in the accompanying tabulation.

An improvement in the drill-round pattern since the above test run was made has resulted in a lower explosive cost.

A jumbo also has been developed for drilling vertical holes on the bench levels. It comprises a framework with hoists mounted on a tractor. This jumbo also mounts four drills which are operated by two men. Over 3,000 tons can be drilled in a shift. At the time of writing, enough work has not been done on a bench to establish direct costs. Drilling and blasting costs, however, are expected to be substantially lower on the benches than in the top heading. Direct costs on both levels are to be established in a public test some time this fall. These, however, are not the ultimate costs to be obtained. Experiments with rotary drilling, for instance, promise that further reductions can be made in drilling and blasting costs.

Gold Producer Starts Right With Low Costs

EAST SULLIVAN MINES, LTD., a new gold producer in Quebec, was confronted at the outset with high prices for labor and supplies. Its success in getting its costs down to the present figure lends special interest to the practices it has adopted and developed.

Currently its operating cost is $2.432 per ton, on a production of 2,500 tons per day. Of this, $0.179 is for development, $1.086 for mining, $0.894 for milling, and $0.273 for administration. This cost, the manager, L. T. Postle, states modestly, is being obtained by copying the best practice that can be found.

The diamond drilling used in breaking ground, with the blasting procedure, is a copy of the Noranda method, Mr. Postle says, modified to suit conditions. The typical orebody, about 300 ft. long by 100 ft. wide and of great vertical extent, is ring-drilled from sublevels 75 ft. apart on its edges. The broken ore is dropped through box holes into scram drifts as used by the Hudson Bay and Climax Molybdenum companies, particularly the latter, and from the drifts is loaded into cars with a 72-in. scraper pulled by a 125-hp. double-drum hoist.

Tramming equipment follows current Canadian ideas in using as large and heavy a car as possible. The size is limited by the size of shaft opening through which it must pass to get underground. The car is of the Granby type, of 200-cu.ft. capacity, theoretically 10 tons. It weighs 22,000 lb. empty, is built to take high shock loads and much abuse. Ten-ton trolley locomotives tram the cars to ore passes leading to a 48x60-in. jaw crusher, which breaks to 6-in. sizes. Scram drifts, cars and ore passes are all designed to take as big a chunk as will go into the crusher.

The milling also shows nothing unusual, says Mr. Postle. A 5½-ft. standard Symons is followed by a 5½-ft. Short Head operating in closed circuit with screens. A big rod mill does the final stage of crushing and is followed by a conventional grinding circuit of ball mills in closed circuit with classifiers. The ground pulp goes through conditioning tank, copper-flotation cells, and finally to zinc-flotation cells.

A change has been under way from detachable steel bits, resharpened by hot milling, to carbide bits in hard ground and throwaway-type bits in average ground. Tests indicate faster drilling speeds with fewer missed rounds, also a substantial reduction in the costs of steel and blacksmithing.

Extended use of jumbos for drifters and a more general use of stoper drills in place of column-mounted drifters are also cutting costs.

Closer supervision of underground transport and hoisting has reduced the cost of transportation. This is done by detailing an assistant shift boss to keep rock and materials moving. Loading has been speeded up and spillage cut by using simplified loading gates at main chutes, says Mr. Arentz.

Supplies are being handled more cheaply by packaging timber and other materials going underground with steel tape, so that a full cage load can be handled as a unit.

Timber-framing cost has been cut by providing a new adequately equipped shop for the purpose.

Better Housing, Lower Costs

COCHENOUR WILLANS GOLD MINES, at McKenzie Island, Ont., is getting 4 tons per man per day, compared to 2.4 tons two years ago, according to W. P. Mackle, manager. Responsible for at least a third of the improvement, in his opinion, is the well-planned housing program the company has instituted, attracting a better class of labor. More than 60% of the employees are now purchasing their homes from the company on a monthly basis. Other factors include the current trend underground to use of a lightweight one-man drill and mechanical mucking, all on a bonus system; also the adoption of the trolley locomotive for long hauls. The latter change has raised efficiency, cut costs.

Nevada Operator Bears Down on Costs

NUMEROUS COST-FINDING PRACTICES have been applied at the Pioche, Nev., properties of Combined Metals Reduction Co., according to S. S. Arentz, general superintendent. Work continues on problems of safe, low-cost mining methods, giving high recovery, that are adapted to the company's orebodies. Some success has been had with undercutting and caving pillars and in salvaging timbers from worked-out square-set stopes.

A production bonus to mine shiftbosses based on increased production per man-shift and reduction in cost per ton of rock has paid off in lower mining costs. Some success is also being had in increasing labor efficiency, with consequent cost reduction.

Selecting a Stoping Method to Meet High Labor Cost

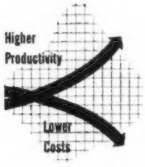
CONFRONTED WITH the high cost of labor and seeking a stoping method that will give maximum tons per man-shift, Copper Canyon Mining Co., in Nevada, has turned to a combination of shrinkage stoping with subsequent sublevel stoping of the pillars. According to R. H. Raring, general manager, the orebody is 200 ft. wide and permits the opening of parallel shrinkage stopes with pillars between. To sublevel-stope the entire body would entail considerable stope development, with a long period of low production while this was being completed. Shrinkage stopes get into production faster. At the same time, each deposit presents its own problem. The tendency, according to Mr. Raring, is to work towards methods that call for least timber and which permit high tonnage per man-shift, even at expense of some dilution, letting the mill do the "selective mining."

In drilling, conversion to bits of the throwaway type has cut drilling costs to half what they were with multiple-use detachable bits. They collar with a 1⅞-in. bit (as compared with 2⅛-in. for the former). An indirect saving on powder is also reported.

A LOWER MINING COST is being obtained by Cleveland-Cliffs Iron Co. in certain areas of stoping ground in its Mather "A" and Athens mines, on the Marquette range in Michigan, by applying block-caving to extracting the soft ores. Here are seen the shafthouse inclosing the 197-ft. steel headframe of Mather "A," at Ishpeming, and the stocking trestles. In front of the shafthouse is the big engine house containing the hoists and the compressors. To the left of the engine house is the mine office.

Cleveland-Cliffs Combats Rising

SAVING OF TIME AND MONEY in Cleveland-Cliffs' exploration diamond drilling is effected by use of steel derricks built high enough to permit breaking rods every 50 ft. instead of at a shorter interval, as they are withdrawn. Studies are being made to increase the interval to 60 ft. The rods come in 10-ft. lengths.



A. H. HUBBELL
Managing Editor

MEASURES TAKEN by Cleveland-Cliffs Iron Co. to lower its costs are worthy of note. Like every other mining company in recent years, it has had to face the problem of mounting wages and supply costs, in both its underground and open-pit mines. In common with other operators of underground iron mines, it also feels particularly the pressure to get its underground costs down, so that the ores affected can compete better with the more cheaply mined open-pit production. Thus it has a double reason for improving its practice wherever possible.

Cleveland-Cliffs is one of the leading operators of the Lake Superior region, with almost a century of experience in mining iron ore. Next year it will celebrate its centennial. Its headquarters are in Cleveland, where its chairman, E. B. Greene, and president, A. C. Brown, and other top executives have their offices. Its iron mining operations are directed from Ishpeming, Mich., by C. J. Stakel, general manager. C. W. Allen and W. A. Sterling are respectively managers for the Michigan and the Minnesota areas. Fayette Brown, Jr., is assistant manager in Cleveland, Grover J. Holt is chief engineer, E. L. Derby, chief geologist, and L. J. Erck, chief metallurgist.

The company's Michigan mines include eight underground operations and one open pit. Its Minnesota group comprises five pits and two underground mines. These have all been active during the present season. Shipments from the two groups last year totaled 8,770,652 tons, comprising both direct-shipping and beneficiated ores. Of this tonnage 4,166,534 tons came from the Michigan mines. A total of approximately 3,200 men are employed in the Michigan and Minnesota mines.

Improvements of Wide Scope

Pursuit of improved practice and lower costs by Cleveland-Cliffs begins with the work of finding ore, and continues throughout the sub-

ANOTHER COST REDUCTION achieved by Cleveland-Cliffs is in the use, under proper conditions, of steel sets instead of timber for ground support. In the rock drift here shown in Mather "A" mine, the fireproofing afforded by the steel sets is completed by the use of concrete lath, seen above the caps, in place of wood lagging.

Costs

sequent development and mining until the ore is delivered to the railroad cars. Of outstanding interest are the changes it has effected in mining methods, notably the successful application of block-caving in some of its soft-ore mines. Another striking improvement has been its cost-cutting, time-saving use of tungsten-carbide drilling in the hard-rock development work needed to open up its deposits of soft ore, as well as in mining its only hard-ore deposit, that of the Cliffs Shaft mine.

Effective use has also been made of long-hole ring-drilling in stoping soft ores, with percussion drills, jointed rods and steel bits. Holes up to 60 ft. long are used, and benching is eliminated, to increase ore breakage and improve safety in sub-level stoping. Steel sets and reinforced concrete lagging have been substituted effectively for wood sets in supporting ground and in fireproofing certain areas. Shaft mucking has been mechanized profitably by developing the use of a clamshell bucket, powered by 5,000-psi. hydraulic pressure, in the latest sinking operation comprising a 15x20-ft. steel-and-concrete-lined shaft to a depth of nearly 3,100 ft.

A strong believer in incentive systems, Cleveland-Cliffs has developed its system of rates to provide equal opportunities for higher earnings under the several mining methods. The company some time ago established a Central Shops and Warehouse Division at Ishpeming for its Michigan mines, and more recently a Central Warehouse at the Holman-Cliffs property on the Mesabi range for its Minnesota mines, thereby getting the benefits of quantity purchasing and cutting its maintenance costs. Previously each mine had had its own shops, such duplication being wasteful. The best skill and best equipment in each shop were retained in effecting this centralization. Fabricating work previously impossible to undertake can now be handled.

The more striking improvements are discussed at length in the following.

Cheaper Stoping by Block-Caving

In the last two years Cleveland-Cliffs has successfully applied the block-caving method of mining in certain areas of stoping ground in its Athens and Mather mines in the Ishpeming-Negaunee district on the Marquette range, and has other similar projects in hand. The application today of block-caving in Michigan iron mines is especially interesting. The block-caving method, devised by E. F. Brown, was first used at the Pewabic, a Menominee range mine, in Michigan, in 1895, but during the past 20 years has not been employed in the state until Cleveland-Cliffs elected to do so in 1947. Elsewhere, under varied conditions, the method has given lower mining costs than have been obtainable with the other methods used in Lake Superior underground mines where lower costs are needed. It is not expected, however, that such cost improvement can be effected save where the conditions are suitable, keeping in mind particularly height of ore in relation to development cost.

With the introduction of block-caving, the underground mining methods employed in the soft-ore mines of the Lake Superior ranges become four in number. The other three are top-slicing, sublevel stoping and sublevel caving. All four methods are used by Cleveland-Cliffs. In its Michigan mines, the company has almost every type of soft-ore orebody. For each, the mining system must be so laid out as to take into account all characteristics of the ore and capping. Of Cleveland-Cliffs' total production from the Michigan underground mines today, approximately 10% is produced by top-slicing, 35% each by sublevel caving and sublevel stoping, and 20% by block-caving.

In contrast, about 15 years ago 75% came from top-slicing and 25% from sublevel stoping. The first change made was to introduce sublevel caving in some places where top-slicing was being used. This was somewhat more than 10 years ago. However, the change did not solve all the problems.

In 1946, the next step was taken. After sending a group of its technical and top-supervisory staff members on a tour of Western block-caving mines, a block of ground in the Athens mine 60 ft. high and 90 ft. wide by 180 ft. long was selected for test purposes, and development for block-caving was begun. The objective primarily was to see how the method would work. The 60-ft. height above the undercut hardly gave sufficient tonnage to promise that the development cost would be satisfactorily absorbed.

The Athens mine was selected for the initial attempt because pressure there had long created serious problems in ground support. Any opening, once made, soon tended to close up. With block-caving, it was thought, advantage could be taken of this pressure. The particular block chosen, moreover, was in an area that had been sealed off five

years before to smother a fire in adjacent old workings. Top-slicing had been tried and given up because the fire hazard had proved too great for working in a timbered slice. But with block-caving, it seemed, the movement of the broken ore in a space cut off from air might retard oxidation and permit drawing all, or at least a good portion, of the ore.

Space for the preliminary development of the block was cramped, owing to the slope of the footwall. Three grizzly drifts, on 30-ft. centers, with two transfer scraper drifts, 60 ft. c. to. c., were sufficient to serve the block. The transfer drifts were driven at the top of the haulage drift timbers to save height. Vertically, the transfers and grizzly drifts were 30 ft. apart. Finger raises were driven to a point 22 ft. above the grizzly-drift floor and were then coned at 45° to receive the undercut ore. Both the fingers and the main raises below between grizzlies and transfer drift were driven on 15-ft. centers No drifts were driven to cut off the block.

The block was caved successfully in six months of operations. Drawing began in September, 1947, and yielded a total of 67,529 tons. It is estimated that over 90% of the available ore was drawn. The daily tonnage drawn varied from 245 to 739. Piping occasionally brought down hot material from the gob above, and trouble from hangups was frequent. Experience was gained, however, in developing methods of overcoming these difficulties.

Tapping of the drawpoints was controlled in the usual manner. Little trouble was had from dilution until three-quarters of the total tonnage had been drawn. Greater care was necessary with the balance to hold the ore to the proper grade. The importance of this control is understandable with an ore in place containing about 6.5% silica, a limit in grade of 9 to 9.5% silica, and a capping above the ore in most areas running over 40% silica.

Following its success with the test block, development of another block was started in the Athens mine, to yield about 300,000 tons. At the time of writing, in September, about two-thirds of this had been drawn. A third area is also being prepared for block-caving in this mine.

In the Mather "A" mine at Ishpeming, three blocks have also been mined, the ore drawn adding up to nearly 180,000 tons. A fourth area in the mine is being prepared for the method which will be the largest and is expected to yield from 200,000 to 300,000 tons.

In a third mine, the Maas at Negaunee, an area has been reserved by setting mining limits that will extend from the fifth to the seventh levels.

Selection of areas for block caving in these mines where the orebodies are so varied and where mining by other methods may be in progress is subject to certain handicaps. Development of too large an area must not be attempted, lest, combined with other operations, it will yield more ore than can be hauled and hoisted at a fast enough rate to prevent the caved soft ore from packing in the drawpoints. Further, as has already been suggested, selection of a block of less than, say, 80 ft. in height will have results in an undesirably high development cost per ton drawn. Omission of the grizzly sub in these areas in favor of two transfer or slusher sub drifts with alternate tapping and scraping operations in each is under trial to see if this objection can be reduced in importance.

Attack on Drilling Costs in Hard Ore and Rock

Of all Cleveland-Cliffs' underground mines in Michigan, only the Cliffs Shaft mine, situated in the heart of Ishpeming, has hard ore—a specular hematite which is very difficult to drill by ordinary means. Up until February, 1948, all ore in this mine was broken with tripod-mounted 3½-in. drifters of the Leyner type, weighing up to 180 lb. and incidentally mostly hand-cranked. Detachable steel bits, from 2⅛-in. starters down to 1½-in., were used. Results obtained with this equipment show that the steel bits averaged 1.627 ft. drilled per use, that an average of 4½ uses including the original was obtained, and the total bit cost, including resharpening, therefore amounted to 8.78c. per foot drilled.

Tungsten-carbide bits were adopted in February, a year ago, for drilling the Cliffs-Shaft ore. Up to July 1, 1949, a total of 261,677 ft. of hole had been drilled with them. Continued experimentation has developed, as standard, the present practice of using Ingersoll-Rand Carset bits with a 2⅝-in., 55-lb. jackhammer on a jackleg mounting. Of 92 contracts currently in the mine on Sept. 1, 60% were using these bits and were equipped with the light drill and jackleg. Substitution of downstroke rotation of the drill for upstroke has extended the bit life. The remaining hand-cranked drifters were being replaced with jacklegs as fast as the latter could be obtained.

Savings From Change

This substitution of carbide bits used with jack-leg-mounted jackhammers for the steel bits used with heavy drifters has increased the footage drilled per bit almost steadily. Accurate records show that for the carbide bits an average of 151 ft. per bit for the seven months ended July 1 had increased, through corrective measures reducing insert breakage and thread strippage, to an average of 349 ft. per bit for the month of August. In the same month, the bit cost per foot was about 4c. less than with detachable steel bits, a reduction of nearly 50%! The change has also increased the blast-hole footage drilled per man-shift considerably, due to faster penetration, and more than doubled the drilled footage per stope due to the fact that on a contract where there was a miner and a helper with one machine, the change has made it possible to use two miners on the contract, each with a machine but without a helper. The two miners drill, blast and scrape their own ore. The pay-bonus system (per hour) remains the same, but extends to both men, not just the contract miner as formerly.

Still further savings from three sources have accrued from the adoption of carbide-insert drilling. The first is a reduction in steel cost due to adoption of the smaller 1-in. quarter-octagon steel instead of 1¼-in. round. This in turn led to a saving in powder cost, which is real but hard to figure. Finally there is a saving in compressed-air cost.

Summarizing, the use of carbide-insert bits at this hard-ore mine has resulted in greater drilling speed and bit life and has reduced the drilling cost per foot of hole. Analysis of incomplete data also indicates that reductions in powder cost, compressed-air cost, and bit-sharpening costs, as well as direct mining-labor costs, are being made. Studies are being made to evaluate them, as well as improve the present equipment and practice.

So far as Cleveland-Cliffs' practice is concerned, drilling with tungsten carbide is limited to hard

ore or hard rock. It has shown no advantage in ground that can be drilled at more than 25 in. per minute with a 3-in. drifter and steel bits.

The underground mines of the company on the Marquette range other than the hard-ore Cliffs Shaft mine have only soft ore, but the rock in which the main haulageways and other drifts are driven is medium hard and so falls within the scope of the foregoing paragraph. In these other mines, 50% of the drilling in rock is still being done with mounted drifters or jackleg jackhammers and steel bits. In the other 50%, carbide bits of Timken make with chrome-plated threads have been found best suited to this drilling, giving as much as 1,200 ft. per bit against 500 ft. with other makes.

To cut down drilling costs in rock in these mines, jumbos with long feeds have been used to permit drilling the round without changing steel. This has lowered the average time for drilling 31 6½-ft. holes to 45 to 60 min. To drill the same round changing steel every 30 in. used to take 1½ to 2½ hr.

Saving With Steel Supports

Steel sets are favored by Cleveland-Cliffs as being more economical for ground support than wood timbers under proper conditions. Experiments that started six years ago in the footwall openings in the Mather mine have led to the development of supports that are actually cheaper, all things considered, than sets of wood, whether the latter is treated with preservative or untreated. While the first cost of the steel sets is high, the expense of erecting them is relatively low, and in addition they require the excavation of a quarter to a third less rock by volume than is needed for wood sets of given inside dimensions.

A comparison, taking averages, shows that the cost for prefabricating a 9-ft., 3-piece steel set of 4-in., 13-lb. WF section is $20, including shop work, handling and freight, as against $8.50 to $10.50 for the equivalent set of 12 to 16-in. untreated round hard maple, including freight, unloading and framing. The purchase cost of the timber, if treated, would be about twice what it would be if untreated. The steel set can be erected in half the time that a wood set takes, the saving in labor being estimated at $4 on the average. According to the management, in repairing main-

haulage drifts, wood sets have commonly been replaced with steel sets at an average installation cost of $10 per set, including removal of the old set from the drift, and completely covering the back and blocking above the steel.

There would be no economy, of course, in using steel in some places, as in transfer drifts under stopes where untreated timber will last longer than the two or three years the drift will be in use. But, for permanent openings such as shaft stations and main haulageways and wherever fireproofing is desirable, the Cleveland-Cliffs mine staff regards the use of steel as imperative.

Cutting Exploration Costs

In its exploration work in Michigan, Cleveland-Cliffs finds that much of its diamond drilling is to vertical depths of 3,000 to 4,000 ft. Few ore disclosures are being made above 2,000 ft., in contrast to the deposits which have furnished most of the tonnage in the past. The company has drilled a single hole 4,106 ft. from surface, the bottom 1,500 ft. of which is in iron formation. Such holes are expensive. Every effort is made to reduce the drilling cost.

The means used to cut costs include:

1. Wedging branch holes off from intermediate points of the parent hole, where additional information is wanted about ground within 150 to 200 ft. of the latter, instead of drilling additional holes all the way from surface.

2. Use of wedging to keep a hole vertical or on its pre-determined course. Thus the hole goes to its objective and eliminates waste of effort, barring occasional mishaps.

3. Use of weighted rods, with pressure gages, to insure the correct weight on the bit, in order to keep the rods more nearly in tension and the hole on its proper course. This also minimizes wear on stones and reduces breakage.

4. Drilling by instrument to minimize blocking of the bit. Every time blocking occurs, the rods must be pulled out of the hole and lowered again.

5. Reducing time required to lower rods into hole and withdraw them, by use of tall steel tripods or derricks. Rods come in 10-ft. lengths. Present derricks are built high enough to break the rods every 50 ft. as they are withdrawn.

6. Use of bits having substitutes for diamonds, such as tungsten carbide, where loss of bit appears imminent or where it is desired to cut metal, as when fishing or cutting out in rough ground.

7. In the effort to improve core recovery, different core barrels have been used, including variations of the single-tube type, the rigid inner-tube type, and the swivelled inner-tube type.

In addition to the above mentioned cost-saving developments now being used, investigations are being carried on to lower cost of exploration by the following means:

1. Increasing the hoisting interval to 60 ft.

2. Increasing size and horsepower of drill rigs to permit hoisting a string of BX rods from a 4,000-ft. hole at an average speed of 200 to 300 fpm. by direct pull.

3. Decreasing time not actually spent in drilling by designing equipment to use the kelly (common to oil-field rigs) in connection with the hydraulic feed. Instead of rechucking every 30 in. or shorter interval, as usual with diamond drills, this would permit drilling 10 ft. or more without rechucking.

4. Use of drills specially improved for deep work. Depths have already been reached, beyond which with present machines higher costs and frequent breakdowns will be experienced. The metal of which casing and rods are made must be improved for greater tensile strength.

A Research Program

The prospect of having to go to depths of 3,000 and 4,000 ft. or even more for its future production of direct-shipping ore, with the deep development work and bigger hoists that will be required, is causing study of the possibility of developing the large surface exposures of lower-grade iron formation on the Marquette range. The question is, will it be economically cheaper to mine in open pits and beneficiate approximately 2 tons of this material to make 1 ton of product than it will be to produce 1 ton of direct-shipping ore from 3,000 to 4,000-ft. depth? To help answer this question the company recently completed construction at Ishpeming of a fully-equipped research laboratory, indicating faith thereby that the problem will be solved.

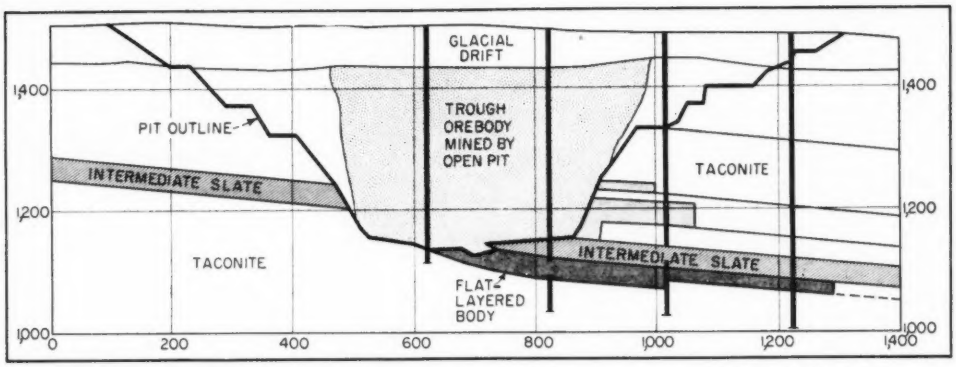


FIG. 1. Lower costs are needed on Mesabi range for mining deeply-buried ore, such as flat-layered body shown.

TABLE I - OPERATING AND COST DATA - 1947 - MINNESOTA UNDERGROUND MINES
Taken from Occupational Tax Reports

	Mesabi						Cuyuna	Vermilion			
	1	2	3	4	5	6	7	8	9	10	11
Gross Tons Mined	614,145	234,330	220,932	198,519	195,885	147,411	215,133	600,731	474,934	214,069	167,602
Grade of Ore – % Fe	48.2	49.9	48.3	51.3	47.1	48.6	49.2	57.0	56.3	59.0	59.6
Mining Method	Drift Slicing	Drift Slicing	Top Slicing	Top Slicing	Drift Slicing	Top Slicing	Top Slicing	Top. Sl. S.L.Cav.	Sub Level Caving	Top Slicing	Cut & Fill
Tons per Man-Hour	0.99	1.15	0.65	1.32	0.90	1.27	1.07	0.67	0.84	0.65	0.63
VALUE – LOWER LAKE PORTS	4.965	5.103	5.077	5.527	4.827	5.121	5.321	6.565	6.641	7.143	7.754
Non-Statutory Costs											
Transportation	2.14	2.142	2.143	2.14	2.141	2.140	2.142	2.142	2.141	2.141	2.140
Other Transportation Costs	.11	.182	.108	.115	.108	.111	.082	.116	.207	.112	.098
Beneficiating								.053		.072	.227
Loading Stockpile	.005	.001	.015	.022	.009	.030	.015	.017	.035	.016	.021
Total Non-Statutory Costs	2.254	2.386	2.254	2.276	2.257	2.280	2.240	2.328	2.383	2.340	2.486
VALUE AT MINE	2.71	2.717	2.823	3.252	2.570	2.842	3.081	4.238	4.258	4.802	5.268
Statutory Costs											
Development	.0012	.004	.007	.033	.102	.097	.068	.039	.080	.026	.050
Labor & Supplies	2.233	2.067	3.298	1.946	2.570	2.025	1.847	2.816	2.088	3.111	5.250
Administration	.0897	.185	.148	.137	.153	.146	.173	.151	.230	.158	.190
Miscellaneous	.0911	.075	.199	.046	.083	.062	.107	.239	.211	.229	.313
Royalty	.2435	.400	.424	.555	.408	.500	.222	.578	.597	.300	
Partial Taxes	.0111	.015	.037	.012	.025	.024	.018	.064	.063	.066	.074
Depreciation of Plant	.0343	.117	.035	.085	.025	.078	.107	.073	.137	.075	.181
Total Statutory Costs	2.704	2.863	4.148	2.814	3.365	2.933	2.542	3.960	3.407	3.966	6.058
TAXABLE VALUE	.0069	– .146	– 1.325	.438	– .795	– .091	.539	.278	.851	.837	– .790

Meeting Higher Underground

E. P. PFLEIDER

Associate Professor of Mining
University of Minnesota
Minneapolis, Minn.

RECENTLY MOST of the money provided for exploiting any of the iron ore reserves remaining on the Mesabi range has gone into the development of open-pit techniques and the purchase of large-scale equipment that these techniques require. As a result, underground mining has been almost abandoned on the range, men trained in underground work have disappeared, and the development of more efficient underground methods and equipment has been retarded. This is the natural outcome of the fact that much of the Mesabi tonnage, now classed as "underground ore," can be mined economically by up-to-date open-pit methods and equipment. The methods that were used in the underground mines before they shut down yielded fewer tons per man and therefore gave a higher cost per ton. It seems evident that had the operators been forced to produce underground ore competitively at even a small profit, as in the case of the low-grade copper properties now being block-caved, the methods, equipment, and costs would be different today.

The percentage of ore mined underground on the Mesabi has fallen continuously every decade since production began in 1892. For the 1892-1900 period it was 37.9%,

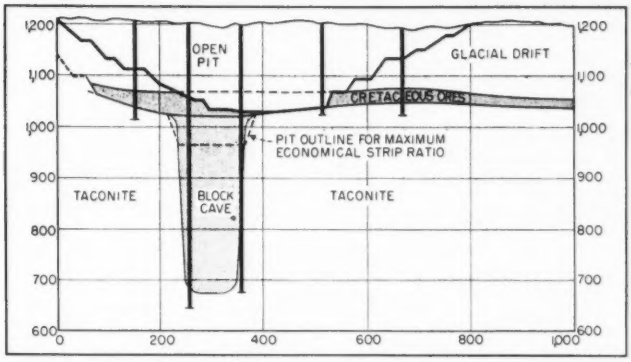


FIG. 2. The possibilities of block-caving this deep-trough orebody are indicated.

TABLE 2 - COST AND VALUE AT MINES
MINNESOTA IRON ORES

COST AT MINES Yearly Averages	1937 Open Pit	1937 Underground	1942 Open Pit	1942 Underground	1947 Open Pit	1947 Underground	
Production Cost(a)	0.704	1.828	.719	2.182	1.046	3.068	
Royalty	0.375	.41	.394	.344	0.327	0.409	
Total Taxes(b)	0.58	.38	.34	.31	0.43	0.30	
TOTAL COST AT MINE	1.66	2.62	1.45	2.84	1.80	3.78	
TOTAL VALUE AT MINE(c)	2.98		2.44		3.19		4.61
Rail Fgt. to Docks	0.81		0.81		0.83		1.08
Lake Fgt. and Dock Chgs.	1.03		1.02		1.37		1.31
Interest, Insurance & Incidental	0.05		0.05		0.05		0.05
Other Marketing Costs	0.08		0.14		0.11		0.15(d)
Price at Lake Erie Docks(c)	4.95		4.45		5.55		7.20
VALUE AT MINE	1937		1942		1947		1949

(a) Includes: Administration (local & district) depreciation, beneficiation, stockpile loading, and miscellaneous costs.
(b) Approximate figures.
(c) Based on Mesabi Non-Bessemer Ore per ton of 2240 lb. - 51-50% Fe Natural
For Mesabi Bessemer Ore . . . . . add 0.15 per ton
For Old Range Non-Bessemer Ore . . . . . add 0.25 per ton
For Old Range Bessemer Ore . . . . . add 0.40 per ton
(d) Estimated

Costs on the Mesabi

today it is 2 to 3%. Underground mines decreased in number from 59 in 1920 to 9 in 1944, and in 1948 to 6 operating mines and 1 developing mine. Oliver Iron Mining Co. is producing from the Godfrey-Morris, Spruce, and Fayal, and developing the Fraser. Cleveland-Cliffs Iron Co. is producing from the Agnew and the Sargent, and Pickands, Mather & Co. from the Bennett.

Five reasons can be given for this decline of underground mining:

1. The development of flexible, large-scale equipment for open-pit stripping and mining. This alone has shifted many deposits to the open-pit category.

2. Advance in beneficiating as well as mechanical handling. Thanks to reasons 1 and 2, it is often cheaper and easier to strip, mine, and treat 3 tons of open-pit ore than to mine 1 ton underground.

3. The big increase in underground mining costs due to failure to develop new methods and equipment to offset the rise in labor costs.

4. Control of the better underground properties by companies having ample supplies of direct-shipping open-pit ores.

5. The lack of skilled miners, mentioned at the beginning. Many men are reluctant to work underground today.

The two common types of orebodies on the Mesabi range which are considered for underground mining are the trough-shaped and the thin flat-layered or fringe deposits. The usual trough deposit is nearly flat, dipping at 8° to 10°, and is of large horizontal dimensions. A major portion is near the surface and accessible to inexpensive open-pit mining. It is doubtful whether any of these trough bodies will be mined in their entirety by underground methods. For the few requiring some underground extraction, the method most likely to be used will be that of mining by open pit to the economical strip limit, and then extracting the deep portions underground. Two typical cases are illustrated in Figs. 2 and 5. Here the bodies narrow in depth to a point where strip ratios required to hold safe pit slopes are excessive. The tonnages remaining for underground mining are appreciable because of their length along the strike. A study of the larger trough bodies indicates there are few major ones, probably less than 10, which will require underground mining for their deep extensions.

The flat-layered bodies extend up and down dip and along the formations from the trough deposits. They are relatively thin, varying from 5 to over 30 ft. in thickness, and represent preferential alteration of a bed immediately underlying the intermediate slate. This condition is shown in the cross-section in Fig. 1. Some of these deposits are extensive, covering areas up to two miles long by one mile wide, and comprising 1,000 acres. They represent an estimated two-thirds of the Mesabi underground reserves. Since these bodies usually surround open-pit reserves, much of the ore will be mined from the pit outcrop and then scrammed or hauled into the pit for removal in that manner.

The so-called Cretaceous ores, a weathering and residual product found in a few areas uncomformably on the eroded surface of the ore formations, can also be considered as flat-layered bodies. This type is illustrated in Fig. 2.

Present Methods

As to past and present underground mining practices, it is enough to say that the soft character of the ore and the weak condition of the back of overburden forced the adoption of a caving system. Safety and the requirement enforced by fee-owners of extract-

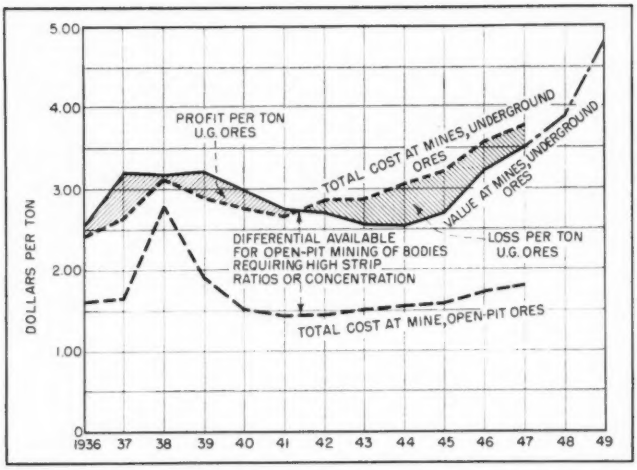

5.00
4.00
3.00
2.00
1.00
0
DOLLARS PER TON
PROFIT PER TON U.G. ORES
TOTAL COST AT MINES, UNDERGROUND ORES
VALUE AT MINES, UNDERGROUND ORES
DIFFERENTIAL AVAILABLE FOR OPEN-PIT MINING OF BODIES REQUIRING HIGH STRIP RATIOS OR CONCENTRATION
LOSS PER TON U.G. ORES
TOTAL COST AT MINE, OPEN-PIT ORES
1936 37 38 39 40 41 42 43 44 45 46 47 48 49

FIG. 3. Trends in total costs at open-pit and underground mines for 1936-1948 period.

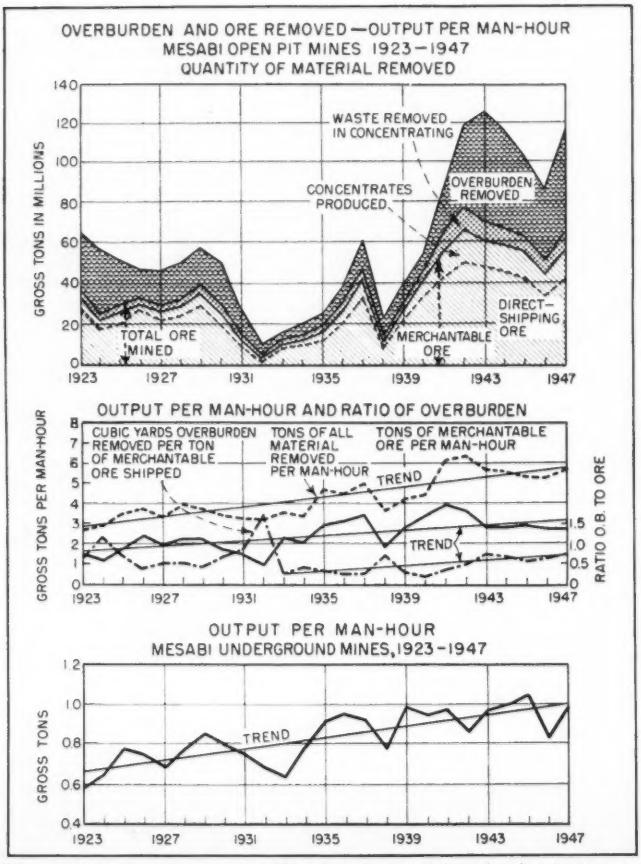

OVERBURDEN AND ORE REMOVED—OUTPUT PER MAN-HOUR
MESABI OPEN PIT MINES 1923–1947
QUANTITY OF MATERIAL REMOVED
GROSS TONS IN MILLIONS
WASTE REMOVED IN CONCENTRATING
CONCENTRATES PRODUCED
OVERBURDEN REMOVED
DIRECT-SHIPPING ORE
TOTAL ORE MINED
MERCHANTABLE ORE
1923 1927 1931 1935 1939 1943 1947
OUTPUT PER MAN-HOUR AND RATIO OF OVERBURDEN
GROSS TONS PER MAN-HOUR
CUBIC YARDS OVERBURDEN REMOVED PER TON OF MERCHANTABLE ORE SHIPPED
TONS OF ALL MATERIAL REMOVED PER MAN-HOUR
TONS OF MERCHANTABLE ORE PER MAN-HOUR
TREND
TREND
RATIO O.B. TO ORE
OUTPUT PER MAN-HOUR
MESABI UNDERGROUND MINES, 1923–1947
GROSS TONS
TREND

FIG. 4. Graphs show ever-increasing difference between underground and open-pit costs.

ing 100% of the ore dictated the use of a slicing method. Through evolution, the slicing-caving systems are the only ones now used on the Mesabi range. With slight modifications in the strict requirement that all the ore be recovered, the less expensive systems of sub-level caving and block caving are being considered where physical conditions permit.

Milling methods have been used for mining the lower limits of open-pit orebodies and undoubtedly will be used in the future. Essentially this is an open-pit operation, employing underground haulage. It competes with trucking or scraping and haulage to a hoisting medium, such as belt conveyor or skip, from pit to surface. The Spruce mine presented a good example of modern milling practice on the Mesabi. Milling still requires safe pit slopes and, therefore, high strip ratios in most cases. In contrast, underground caving methods require no attention to pit slopes or surface conditions, other than the possibility of damage to surface installations. Both top-slicing and sub-level caving permit more selective mining than the milling method, though admittedly more expensive. Under close control, it is possible that block-caving might be as selective as milling. Milling definitely has application where underground hoisting and haulage facilities are already available and where the extensive pit floor is such that little additional stripping is required to establish a milling program.

Costs Unsatisfactory

The picture for underground mining costs is not a good one. Average production costs per ton for underground ores in Minnesota increased from $1.83 in 1937 to $3.07 in 1947, or 67%. During the same decade, the indicated average profit per ton decreased gradually from $0.57 in 1937 to a maximum indicated loss of $0.54 in 1944. Since 1944, this loss has been diminishing, and there should be a return to the profit column for 1948 and 1949. Meanwhile, average production costs per ton of open-pit ores varied between the low of $0.62 in 1940 and $1.05 in 1947, or an increase of 70%. The ratio between

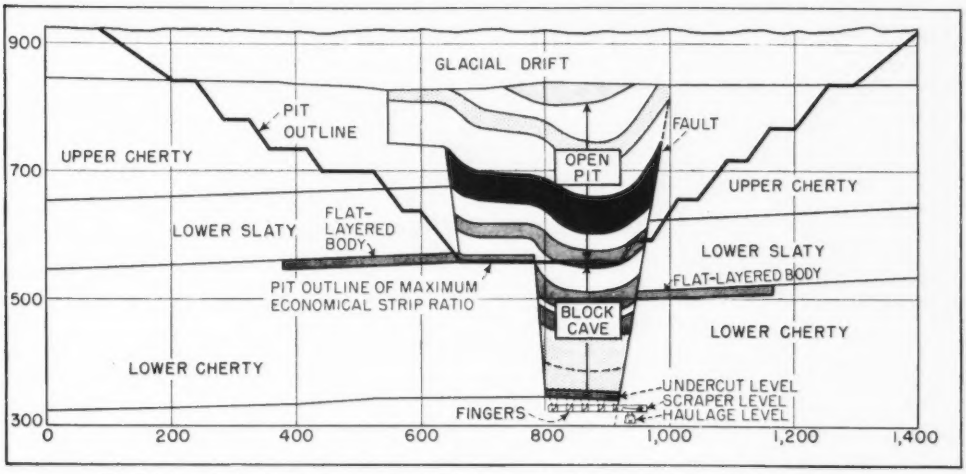


FIG. 5. Scheme for developing an underground body of ore on Mesabi with preparatory work below the deposit.

underground and open-pit production costs thus remained constant at about 3 to 1, even though the cubic yards of overburden handled per ton of merchantable ore produced in open-pit mining increased from 0.17 in 1940 to 0.72 in 1947. Tables 1 and 2, on pages 98 and 99, give the detailed breakdown of the various charges, and Fig. 3 presents the trends graphically.

The ever-increasing difference between underground and open-pit costs is best explained by a study of the graphs in Fig. 4 (data to 1937 have been taken from "Iron Mining," by Kiessling and others). In open-pit mining, for all material handled the tons-per-man-hour increased 107% from 2.8 to 5.8, and for merchantable ore produced the tons-per-man-hour made an increase of 100%, from 1.5 to 3.0. Underground practice, however, improved only 50%, the tons-per-man-hour of merchantable ore produced increasing from 0.66 to 1.0. The increase of 100% in productivity in open-pit mining was realized in the face of higher percentages of concentrating ore and higher strip ratios.

In the open pits of the iron ranges, it is general practice to use the term "equivalent yard." The various types of strip material are brought to the same basis by multiplying the yardage in each case by a factor that is roughly proportional to the cost of stripping. Factors used are as follows:

Class	Factor
Surface Material	1
Paint Rock	1½ to 1¾
Taconite	2 to 4

If the surface material is glacial drift of a sandy nature that can be handled by dragline, the factor should be about ⅔. Assuming a stripping charge for surface material of 25 cents per equivalent cubic yard, the maximum strip ratios of 6 equivalent yards of overburden to 1 ton of ore, now current, could be increased to 10:1 and still beat underground costs.

This explains why such an orebody as the South Agnew, having an average ratio exceeding 3:1, was converted in 1947 from an underground mine to a strip operation. The excavator used in stripping is an 1150-B (Bucyrus-Erie) walking dragline, which swings a 30-cu. yd. bucket on an 180-ft. boom, to feed a self-moving hopper and screening plant built on the base of a 550-B shovel. This plant screens out material over 9 in. in size and feeds the undersize to a conveyor leading to the dump. The combination unit strips 1,000-1,200 bank yards in an 8-hour shift and transports it 6,000 ft. to a point that is 150 ft. higher in elevation. The use of draglines was adopted from coal-field and phosphate-mining practice and marks a trend in stripping on the Mesabi. In addition to the 1150-B dragline, two 9-W (9-cu. yd.) and one 7-W (7 cu. yd.) units are either in operation or under erection. With such large-scale strip equipment becoming the vogue, the low stripping charges per cubic yard coupled with a cost differential between open-pit and underground mining varying from $0.96 per ton in 1937 to $1.98 in 1947, will permit increasingly greater strip ratios.

The coming decade will see open-pit operations having over-all equivalent ratios of between 6 and 8:1, with maximum ratios in excess of 10:1 under good conditions. The course of underground mining is dependent on this factor.

Practice Changing

Now that the price of ore has increased to $7.20 delivered at Lower Lake Ports, or 62% above the 1944 quotation, the solution of the problem of activating underground mining on the Mesabi lies largely in the continued development and use of mechanical equipment and the fostering of new methods and techniques. Any control of costs must be achieved through operating efficiencies, with higher output per man-hour.

The shortage of skilled miners forces a resort to mechanization. Much has been done. Studies have been made of the application of such equipment as mechanical muckers, shaker conveyors, and scrapers. Between the mining of the flat-layered orebodies and low-dipping coal seams there is a certain similarity, and in these cases the use of trackless loaders and shuttle cars is being considered.

Scrapers were introduced on the Mesabi in 1916 and have increased in usefulness continuously since. Shaker and belt conveyors had their first application at the La Rue mine about 1938. They have reached their highest stage of development today on the Mesabi at the Bennett mine, where a combination of 48-in. scrapers, 24-in. shaking conveyors,

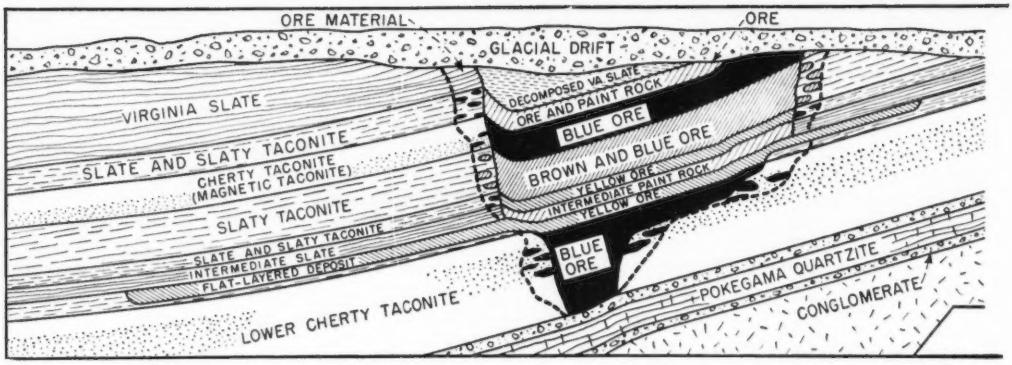


FIG. 6. A generalized cross section of Mesabi range, looking west. Depth and dip

with a 30-in. belt, transport the ore 2,000 ft. from the working face to the shaft pocket. A three-man crew drills, blasts, and mucks out two alternate headings per shift, with a production in excess of 100 tons. Trouble had been experienced in handling sticky ore with the shaker conveyor, but the manufacturer has developed a new eccentric motion to move ores ranging through all degrees of stickiness.

The employment of mobile loaders and shuttle cars is in the experimental stage. The equipment must be rugged. Stronger units than those used in handling coal and potash have been built for mining limestone and Alabama iron ores. Where used, such trackless equipment has proved flexible.

Cheaper Mining Sought

Any discussion of different methods of mining must include the possibility of using sub-level caving as well as of the application of block-caving. In general, the flat-layered bodies must be mined by some slicing-retreating method. When the thickness of the ore does not exceed 15 ft., the bed can be taken in one slice. When it is over 15 ft., there is a tendency at present to use sub-level caving, although top-slicing with mat layers is the usual practice. Such lower-cost systems as room-and-pillar or prop-slicing, widely used in coal mining, are seldom applicable due to the weak back, requiring immediate support, and the need of high recoveries.

Increasing scarcity of good timber and its consequent high price present a problem that is becoming critical. Much of the native timber in Minnesota that has been suitable for mine use has been exhausted. Some feel this condition can be eased by initiating a practice of timber recovery in mining flat-layered bodies, particularly in drift slices. Coal mines have developed a method of recovering caps and posts in retreating and caving operations that might be applicable.

Another possibility is the use of steel. Cyprus Mines adopted "steel timber" for their top-slicing with such good recovery that their steel costs were but 5 cents per ton in a dense sulphide orebody where rusting conditions were excessive. Van Slyke has suggested that development of posts and caps from plywood materials be studied. The preservation of mine timber by treatment with chemicals is gaining acceptance. Where the ground is held open long enough to justify the use of treated timber, such use merits consideration. A reasonable estimate of the average life of treated timber is 12 to 15 years, as compared to less than 5 years for untreated timber.

Sub-level caving is now employed by the Oliver Iron Mining Co. for about 50% of the production from the Spruce and Fayal mines. It is understood that experiments are under way to use sub-level caving on the thin-layered bodies at the company's new Fraser mine. Cleveland-Cliffs Iron Co. uses this method at its Sargent mine and is preparing to change over from top-slicing at its Agnew property. Experience to date has shown that the grade drops only slightly due to dilution, and the tonnage recovery increases proportionately.

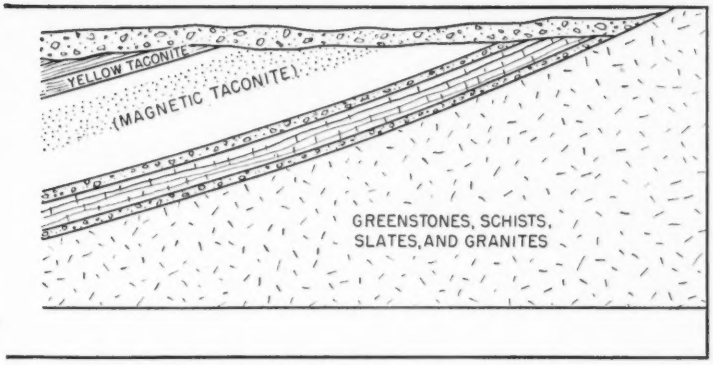
Attention to Block-Caving

Block-caving may be practicable for mining some of the deep extensions of trough orebodies, such as shown in Figs. 2 and 5. This method originated at the Pewabic mine on the Menominee range in 1898, where large blocks of strong siliceous iron ores were thus mined successfully. The system was not adopted at other properties on the ranges because selective mining was preferred for high-grade ores, and with cheap labor the mining costs were reasonable. It remained for the copper properties having large disseminated orebodies to develop the system into the low-cost operations famous today. However, the method is being used on the Marquette range, in Michigan, where Cleveland-Cliffs is caving some ore blocks successfully at some of its mines.

It is generally conceded that Mesabi ore would cave satisfactorily, although there would be a problem of handling the sticky ore through the fingers. The Sunrise mine of Colorado Fuel and Iron Co., in Wyoming, successfully block-caves an iron ore consisting mainly of an earthy hematite averaging 56% iron and resembling the Mesabi ores. Although the material tends to pack and to form vertical pipes, especially if moisture is present, it is drawn satisfactorily at the rate of 22 tons per man-shift.

Two Requisites

Requisites for block-caving on the Mesabi would be: (1) that the orebody is relatively homogenous and (2) that it has sufficient height of ore to justify preparatory costs. If the deposit contains horses, or layers of lean ore and taconite,



angle are exaggerated in relation to width.

these might preclude its use. However, controlled drawing of blocks has been developed in western copper mines to a point where admixture can be held to a minimum and the waste drawn and discarded. Certainly any deep-lying homogeneous body of sufficient height and of an intermediate grade that requires beneficiation would be ideal for block-caving. For such blocks, if delimited, block caving should become a reality.

Developing a Block

Granted that there are some potential bodies for block-caving on the Mesabi, one visualizes that a slusher-drift layout, as developed by Climax Molybdenum, would be ideal. The haulage drift and slusher drifts could be driven immediately under the orebody, with the undercut level driven along the base of the ore. It might be necessary to have grizzly or transfer levels as in Michigan. The slusher drifts could be either concreted or timbered, dependent on the character of the ground and the tonnage above. In general, it should be possible to mine the entire ore height with one undercutting operation. These features are shown in Fig. 5.

It is conceived that the top portion of a trough orebody would be mined generally by open-pit methods to the economical strip limit, leaving the deep extension uncovered and hence free to be block-caved without causing worry as to admixture from glacial drift. In the rare case that this is not true, it would be necessary to prepare the block by mining out a few slices immediately under the glacial drift to provide a mat for separating the caving ore and waste. This top-slicing procedure might not be required where a sufficient thickness of hard taconite separates the orebody and glacial drift. The Sunrise mine, as well as Climax Molybdenum and some of the porphyry copper properties, often use raises, fringe or boundary drifts, and shrinkage stopes to delineate the blocks. It is doubtful that this practice would be necessary on the Mesabi, where the line between soft ore and hard waste is often relatively vertical. Caving experience, as reported by M. H. Kantner, John Vanderbilt, and F. S. McNicholas, has shown that many materials have an initial break-and-cave line varying between 80° and an overhang angle of 95°. This would imply that the weak trough orebodies could be caved to their rock-wall cross-sectional boundaries simply by extending the undercutting level out to the waste contact.

A comparison between general block-caving practice and Mesabi top-slicing shows a production of 20 tons per man-hour, with an average direct mining cost of $1 per ton, for block-caving against corresponding figures of 8 tons and $2.50 for top-slicing. The figures for sub-level caving lie somewhere between these two, although somewhat closer to those of top-slicing. This comparison presents the best reason for serious consideration of block-caving whenever conditions appear favorable.

For the Future

A life of 75 years is indicated for Mesabi underground ores by dividing the 1948 production rate of 2.2 million tons into the reserve of 165 million tons estimated for such ores, both proven and potential. This life far exceeds that indicated for the open-pit direct-shipping ores of the range. The current high rate of exhaustion of the open-pit ores would be relieved by the speedy development of taconite concentration, by any rise in production of competitive ores elsewhere in the United States, and by the importation of foreign ores. It is likely, and desirable, that the demand for open-pit ores be relieved even further by a gradual increase in underground production to a suggested annual goal of 4 million tons by 1960. Such a goal is predicated on two suppositions: first, that the Mesabi underground reserves represent 7.4% of the total potential of the Lake Superior district, and second, that iron ore requirements from the Lake Superior district will decline to 60-odd million tons in normal years. The proportional production for Mesabi underground ores under these conditions would be 4.5 to 5 million tons per year. This doubling of shipments of underground ore over the present figure would save equivalent tonnages of readily available open-pit ores for periods of emergency.

Some Delay Likely

There is evidence that such an expansion of underground mining on the Mesabi range is under way.

Mining of the underground ores that occur as deep-seated trough deposits underlying open-pit bodies, or flat-layered fringe deposits surrounding open-pit workings, must await the completion of the open-pit operations in the same ore area. This means that the exploitation of many underground reserves will be delayed until the late years of the life of the range. To avoid an abrupt conversion to underground mining late in the Mesabi's life, mining should be started at an early date on those orebodies that are independent of open-pit operations.

Most of the larger underground bodies can be mined profitably at today's ore prices. With a return to more normal markets, the underground operations can maintain these profits only by improved efficiency and a change in methods.

The publications and opinions of authorities on Iron Range mining and related practices have been studied and employed extensively in preparing this article. Help has also been obtained from individuals connected with the mining industry of Minnesota, the Minnesota School of Mines and Mines Experiment Station, as well as the State Department of Taxation, to all of whom I am grateful.

Ten Ways to Cut Your

GRINDING STILL OFFERS the biggest target to millmen anxious to bring down the rising cost of milling. Here are reports on some recent successful efforts to cut that biggest item of cost.

These reports are grouped into the ten divisions into which they seem conveniently to fall.

1. Eliminating part of feed has cut grinding costs for many base metal operators. Typical is this report just received from the Aluminum Ore Co. at Rosiclare, Ill., milling fluorspar.

"A very important cut in milling costs was made by installing an HMS unit to preconcentrate ore values ahead of grinding and flotation. This unit discards about 28% of the crude ore as a coarse waste which carries only 2% of the value present in the crude ore. Flotation reagent consumption has been lowered 28%, but consumption of grinding balls is down 68%. No doubt this is due to elimination of the coarse waste, which is most expensive to grind. Grade of final concentrate has been maintained, and the over-all recovery of mineral has been increased two to three percent."

Several small mining operations in Utah, Montana, the Iron Country and the East have recorded cost reductions by doing this same job with Wemco's Mobil-Mill, the portable HMS plant.

2. Improved quality of feed has a lot to do with lower costs. Idaho-Maryland, for example, found that it cost much less to crush than to grind its ore. Result was installation of a fine crusher to take ball mill feed down to minus ⅝-in. instead of the plus 1-in. formerly supplied to the grinding circuit. This reduced the combined crushing-and-grinding cost and also raised mill capacity.

Larger mills have found it to be even more economical to use rod mills to produce a finer ball mill feed. Choice between a rod mill and any of the excellent new small secondary crushers now available would depend on tonnage and several local factors requiring close calculation.

Uniformity of feed is also important, but no one has yet come up with a complete answer for small or medium-sized mills. At Columbus recently, King, of Eagle-Picher, told of using a spiral classifier to even out a sticky feeding problem. Sands, at 15% moisture, went to the ball mill feed box; overflow, at 10% solids, went directly to flotation.

3. Redesign of circuit has cut costs in many plants. International Nickel went from all-rod grinding to rod mills followed by ball mills. Results were excellent. Anaconda is gaining increased tonnage and lower costs by replacing its outmoded rolls with rod mills. Consolidated M. & S. Co. at Chapman Camp, B. C., is using Sink-Float to get rid of gangue at a coarse size and has also redesigned its grinding circuit to accommodate the biggest rod mill running.

At the Allenby concentrator, Granby has increased output by adding classifiers to get more sand raking capacity. A 5% increase in the percent solids in classifier overflows raised flotation output 20%. This raised plant capacity and lowered cost-per-ton with a minimum capital expenditure.

4. Needless over-grinding raises costs and puts good mineral into the wrong places, as Bunker Hill and the Sidney mills are finding out concurrently. Next month Frank McKinley will tell about his "flash grind," which apportions grinding effort according to need and avoids the bad effects of producing galena or sphalerite slimes.

The Dorr Co. should soon be able to report fully on the new Hydroscillator, a classifier that has been under test for some time at Tennessee Copper. It is said to offer a cleaner sand product than former devices, hence, less over-grinding.

5. Maximum output per unit means lower cost per ton. Thinner liners, faster speed, finer feed, bigger raking capacity, type and size of ball, properly placed liners, all contribute to this end. However, maximum output is gained at some sacrifice in liner and ball wear, and the calculation is a close one. Study of the various writings of E. J. Duggan of Climax will show how to get the ultimate capacity out of a given ball mill.

6. Power can be saved if one can emulate Jack Myers and replace three small ball mills by one enormous ball mill. In a progress report, delivered at Columbus, Jack showed that his new 10x12-ft. Hardinge Tri-cone mill has yielded as much as a 28% saving in power over the previous three-mill circuit. The big mill, loaded with 1-in. Molycop balls, treats 10-mesh rod mill discharge. It runs at the slow speed of 13.7 r.p.m. (56.5% of critical), although other speeds have been tried. It runs on water-lubricated Micarta bearings, which have proven satisfactory in the year that the mill has run. These alone were estimated to yield a 4% power saving. This mill is certainly the most interesting single development now in progress in the whole field of grinding.

Grinding power can, of course, be saved in many ways. Probably the most common waste of power is running the mill too fast for its load, or in improper loading of the mill. The literature is full of advice on these, and related, points.

7. Mill liners can save money if properly chosen and handled. It will probably never be possible to point to one type of liner as being the best for any particular job, but knowledge on the subject is increasing. For example:

One large mill can re-line a 7x10-ft. ball mill with a rail-type liner for $1,000, including materials and labor. You can do this only if you can get scrap rail for about $15 a ton and can afford to take a mill out of the line for about 24 hours. This liner lasts 1,000 days in a ball mill treating 400 tons daily of 8-mesh feed, grinding to 10% on 100 mesh.

Grinding Costs

Speed is 16.6 r.p.m., ball load is 40%, using 2-in. balls. Steel use amounts to 0.053 lb. per ton of original ore, which is medium-soft.

If you run ship-lap (or step-type) liners with the high side trailing, you should get maximum tonnage through the mill. If you reverse them so that the high side leads, tonnage will drop but you will get lower power used, more grinding efficiency, and longer liner life. This statement is put out this flatly to see if it develops an argument.

At one mill, a change in type and composition of liner gave the following results:

Type	*Comp.*	*Cons., lb./ton*	*Cost, c./ton*
Wave	Low-alloy	0.1837	2.11
Step	High-alloy	0.0732	0.81

This was in an 86 Marcy 8x6-ft. overflow-type mill running at 22 r.p.m. with 3-in. balls. Ore is medium-hard, the mill takes 475 tons daily of new feed at 2% plus 1-in. and grinds it to 64% minus 200 mesh. Power consumption is 8.65 kwh. per ton.

Longer liner life and fewer shutdowns were obtained at Tennessee Copper by simply zincing-in the rod mill liners as one would a crusher plate. It was never necessary thereafter to shut down to tighten loose liner bolts. There weren't any. Also the liners were run down to about ¼ in. or thinner.

An attempt is being made to collect and correlate data such as the foregoing in the hope of developing a pattern that will at least narrow the field of search for the right liner-mill combination for a given job.

8. Grinding balls are a substantial item of expense, especially if the mill is allowed to grind steel instead of ore. There are few mills, indeed, where this battering of steel on steel does not occur much more frequently than it should. The rattle of disintegrating steel must be particularly painful to users of forged alloy balls. They deserve better treatment.

Weight of ball charge, size of ball, or ratio of different sizes in charge have to be related to the kind and size of feed and product, output desired, speed and size of mill, and other factors. Certainly there is no easy means of selection. It still takes several months, or even years, to run complete comparative ball tests, although Climax has reported on a quick way of getting an idea of relative rates of ball wear.

Balls of different compositions are punch-marked, then tossed into an operating mill. Fished out of the mill after a week or so, their differing rates of wear indicate comparative value. One operator tried marking such balls with radioactive tracer elements, hoping to make them easier to reclaim from the mill. However, when he began poking about the inside of the mill with a Geiger counter, it got the crew so jittery over possible "radioactive poisoning," he had to give up the idea.

Just the matter of getting new balls into the ball mill is probably costing more than it should. One mill handles them with a lift truck and an electro-magnet. Another rolls them down long chutes from a central bin. Balls that have to be handled three times or more between the car and the ball mill cost substantially more than the invoice shows.

Rods are coming in for a share of testing, too, and we should hear more of comparative tests on different rod types in the near future.

9. Proper speed means a lot in capacity and in liner and ball wear. The tendency seems to be to speed mills up when the pressure for tonnage is on, and to slow them down when efficiency, rather than tonnage, is the watchword.

No plant is too small to escape the need for checking on proper ball mill speed. Too fast a mill may be forcing through tonnage you don't need, or it may be needlessly grinding down the ball charge and the liners.

About 55% of the critical speed seems a safe, conservative figure for a low-speed mill. Critical speed? See Taggart.

For a rod mill, speed is even more important. In a new 9x12-ft. rod mill, started recently, the original wave-type liners wore out in handling 100,000 tons. Ni-hard liners, in a ribbed profile, ran 348,000 tons. Utaloy liners, at last report, had passed 380,000 tons and were still going. The principal difference here was that the wave-type liners were unsuited to the speed of the mill. The rod mass simply slid about on the liner surface because there was nothing to grip individual rods. The ribbed liner stopped both this friction and the heavy wear.

10. Control of the grinding circuit is all-important as a final factor in cost cutting, whether you do it by hand or with some one of the many control devices that are available to the operator.

Proper control is vital in making Bunker Hill's flash grind work, and in keeping any mill properly loaded and running economically. This means proper training and re-training of operators. They can help get costs down if you show them how. When you go home at night, it pays to be able to leave behind a cost-conscious capable operator who will work to save money for you and the company.

On the instrument side, Cochenour-Willans says that a Hardinge electric ear has helped obtain a tonnage increase of 15%. Flotation is also improved because the grinding circuit has smoothed out and surges are eliminated. Tailing loss decreased 15 or 20%. Classifier is speeded up 8 strokes a minute. Result is that a 6x8-ft. A-C ball mill now grinds 270 tons daily to 60% minus 200 mesh, as compared with its former mark of 200 tons to the same size.

At Sunshine, fine grinding has been improved by adding an automatic recording density control to classifier overflows. The classifier motor also automatically adjusts the ball mill feeder. This insures that the optimum circulating load and the maximum rate of grinding will be secured.

Carl Marquardt still has the best density recorder, and potential controller, in the models he has built and installed at Pioche and Bauer. It is hoped that details can be released on this remarkable unit in the near future.

WASHINGTON REFLECTIONS

McGraw-Hill Washington News Bureau

Why The O'Mahoney Subsidy Bill Failed To Pass The Eighty-First Congress

PAUL LEACH, JR.

"Too much and too late" can be the terse explanation of why the National Minerals Act of 1949 (S.2105) failed to get past Congress last month.

It was a close thing, only 20 votes prevented the bill's final consideration by the House. Had the proposed suspension of rules, on which the initial vote was taken, passed the House, the bill would have had a chance of passage.

The Senate passed S.2105 after amending it to provide for a "repayment" clause which would return to the Government some of the funds advanced for an exploration project which struck it rich.

The bill was sent to the House, and was quickly amended by the Public Lands Committee under the guidance of Rep. Claire Engle of California. The bill hit its first real snag when the House Rules Committee refused to give the bill clearance for floor action.

Rep. Engle, on the floor of the House on Oct. 17, asked for a suspension of the rules to allow the bill up out of turn on the calendar for final consideration.

After considerable argument, the motion was voted, with 176 "yeas" and 110 "nays." For a two-thirds vote, necessary to pass the motion, the "yea" side needed 196 votes. A change of 11 votes would have put the rule across. The loss of the motion, however, killed the chances of the legislation for the year. It can still come up next year.

A study of the list of those Congressmen voting "no" on the motion shows them predominantly from the East and South. There was no apparent party-line grouping, both Democrats and Republicans were against, and for, the bill.

There was just too much amendment-making to please the White House special staff. S.2105 as it was passed by the Senate, was just barely acceptable to the Administration. House tinkering with the bill tipped the scales the wrong way.

Up to the time of the House changes, there was only one thing the Administration was really opposed to. This was the clause that provided "adequate allowance shall be made for depletion and depreciation in computing costs of operation or maintenance." This would have given operators the equivalent of a profit. The Administration did not intend this bill to be a profit-maker for operators. It was intended to keep a select few of them barely alive.

There were three changes made by the House Public Lands Committee which caused the Administration to put the heat back on.

First: The House added manganese, mica, chromite, mercury, and tungsten, and "other ores of minerals and metals" to the mandatory "small mine" clause in the bill. This clause would have provided that simple contracts covering exploration projects would be awarded upon application to small mines, and would provide for a 50% Government contribution to total reasonable costs. In the definition of small mines, the Senate version of the bill defined them as "mines or deposits primarily producing lead, zinc or copper ores, or combinations of the three, the average aggregate monthly production of which does not exceed 100 tons of copper, lead and zinc combined."

Also, in changing the small mine definition, the Engle committee amended the tonnage limit. Here the definition read—"the average monthly production of which, by quantity, approximates the market value of 100 tons of lead computed and fixed as of the effective date of this act, the quantity limitation for each mineral and metal thereafter to remain unchanged."

This would have meant a money rather than tonnage ceiling on the mandatory exploration contract. The ceiling would have had an approximate $30,000 value.

The $30,000 ceiling could not have been made to work. If, as was claimed on the House floor, 6,000 mines have shut down since 1940, the Government contribution (50% of costs) for these mines would have gone over $90,000,000 just for exploration projects alone—and only $80,000,000 was allocated per year in the first place. Of course, the Interior Department would have had the power to limit payments and total expenses for the exploration part of the bill, but there would have been trouble, anyway.

Second: The House added a section at the end of the bill which would have provided for advance payments for exploration projects on certification by the producer of need for working capital. This, linked with the $30,000 ceiling for the "small mine," would have been an opportunity that few could afford not to take advantage of.

Third: The House removed a Senate amendment which would have provided restitution of Government funds put forth for exploration for a project it if paid off in profitable findings.

Also: Economy-minded Congressmen did not like the money side of the bill, which set up appropriations of $80,000,000 a year for a possible five-year period.

There was also the suggestion of a broken political agreement concerning the bill. Rep. E. E. Cox of Georgia, member of the Rules Committee, pointed out during the debate on suspension of rules, that "bringing up this bill under suspension of rules is shocking to me. It violates what I understand was an agreement to let this measure pass over until the beginning of next year. . . . When last before the Committee during the latter part of the week just passed, the Committee passed up this matter with the understanding that it would be taken up in January, which, I was assured was satisfactory to members of Congress urging the legislation and to representatives of the small miners who would be benefited thereby. The bill in its present form is not satisfactory to many people, or to a majority of this body. They should be given time to acquaint themselves with all of its provisions and to the extent that it subjects the Treasury to being operated upon by the beneficiaries of the bill."

Rules Committee chairman Rep. Adolph Sabbath of Illinois, in speaking in favor of passage of the bill, answered charges that there had been agreement to let it wait until next year. His statement was: "I was at all times in favor of giving these people relief as the prevailing conditions are very serious. However, when I realized that the gentlemen who do not come from the West, but who come from the South and East, were not in favor of granting a rule on this bill, I concluded that we might as well let it go over because it was impossible for me to have . . . the votes of the majority of the other members of our committee."

Rep. Christian A. Herter of Massachusetts spoke the most biting piece against the bill. First, he pointed out that the Engle committee had stricken the repayment clause, and had added all metals and minerals to the mandatory "small mines" section, with a stabilized $30,000 a month exploration contract ceiling. Next, he launched an attack on "subsidizing labor."

"Obviously," he said, "all of us are terribly sympathetic to the miners who are out of work. On the other hand, I cannot recall, when the textile workers in Massachusetts or the workers in shoe factories were unemployed, that anybody suggested that we should begin to subsidize the textile or shoe industries. If we begin now out of sympathy for the unemployed to subsidize every private industry in this country which has unemployment—if we begin to do that as a matter of national defense—then we are in serious difficulties."

"Today the stockpiling act has money enough. This (S.2105) does not provide one penny to buy further minerals for stockpiling. Prices are certainly pretty low so that they could be purchased. This (the bill) does not add one single bit of copper, or lead, or zinc, or any other of the rare materials that the stockpiling act would enable us to obtain. Except for the rare metals that have been added to this bill and which have nothing to do with the Senate bill as it came to us, the primary materials considered in this bill are lead, zinc, and copper, and their added production would not change the stockpiling act in the least."

Rep. Herter's comments concerning the bill's contribution to the stockpile were a repetition of what was said by several other opponents in the Senate debate.

The Senate fight over the bill was an apt demonstration of the generalship of Sen. Joseph C. O'Mahoney, its original sponsor. After more than two hours of debate on the Senate floor, attended for most of the period by less than 25 of the Senators (most Senators were watching the World Series on television in the press room), the bill was passed by voice vote. Although the chair recognized the "ayes" as having it, observers could hardly distinguish the difference between the "ayes" and the "nays." Nor did any of the opponents question the lack of a quorum, which was doubtful at the time of the vote.

One of the contributing factors to the passing Senate vote was the fact that Sen. O'Mahoney was able to answer opponents with the fact that during hearings on the bill there had not been one person from industry to appear before his committee in opposition to the legislation. This had considerable effect in holding down objection to the bill on the Senate floor.

Next year, unless there is a lot more organized opposition to the bill than has been evidenced so far, it is almost sure to pass. Probability of a presidential veto, however, is another matter.

It is obvious that there will have to be a meeting of Senate and House minds over various late amendments to the bill. The Senate made concessions to the administration when it was pointed out that the wording of certain amendments would have made it possible for the bill to be used as an easy-money proposition by some people. The House amendments open up those objections again.

Devaluation May Hurt U. S. Metal Mines

Foreign currency devaluation has resulted in cautiousness—both on the part of industry and Washington. And that is about all so far. The future, to the U. S. however, isn't promising.

Prices of many non-ferrous metals in sterling markets were set as high, dollarwise, after devaluation as they were before. Others were dropped only slightly.

Actually no one in Washington is willing to venture any precise guesses on the final outcome. It will—they say—take many months before a definite pattern emerges from the confusion created on the morning of Sept. 19.

Meanwhile, industry is being very cautious with its buying. Tin, for instance, which dropped from $1.03 per pound just before, to 95c. just after devaluation isn't being ordered for delivery for much more than one month in advance. Industry apparently shares Washington opinion that the Jan. 1 price will be closer to 70 or 80c. Likewise lead prices are expected to drop lower by the first of the year.

As a direct result of devaluation, the spread between U. S. and Canadian-U. K. aluminum prices was widened by another 3c. This means greater substitution of aluminum for copper in soft currency areas. At the same time, lead and zinc purchases by non-dollar buyers are expected to shift more and more to Australia and other devalued areas.

Devaluation will speed up the tendency to do more and more of the processing at home. For instance, ECA forecasts that within another year Europe will be entirely independent of U. S. refined copper. At the same time, they'll be buying more and more blister from Chile and Peru, traditional sources of supply for the U. S., according to Marshall Planners. Throughout the whole range of ores and concentrates, when current procurement contracts run out U. S. buyers will find a lot more would-be purchasers competing for existing supplies.

Iron and steel haven't seemed to notice devaluation. Iron and steel scrap prices seem to be continuing their steady rise started last August. However, cost of U. S. manufactured finished and semi-finished steel was jumped as much as 43% in devalued countries. This can't help but speed decline of U. S. exports. Increased competition in so-called third markets, from European producers capable of taking price advantages resulting from devaluation, will be a pressure for generally lower U. S. export prices.

Again, there is no way now of appraising accurately what the future holds. It's too early yet. But the feeling that many prices will drop a little at least, is prevalent. Just when and how much can only be determined as it happens. If, as rumored, the London metal market is completely reopened, the drop will come sooner, rather than later.

Increase Is Slow In Non-ferrous Jobs

Employment outlook in copper, lead and zinc mining has brightened with the recent upturn in prices, but employment is slow in reflecting the small price recovery, according to reports received by the Bureau of Employment Security.

Employment was highest in March when, the Bureau of Labor Statistics reported, there were 42,300 production workers employed compared with an average of 39,200 during 1948.

There was a 6,500 loss in jobs by July, two-thirds of it in lead and zinc mines.

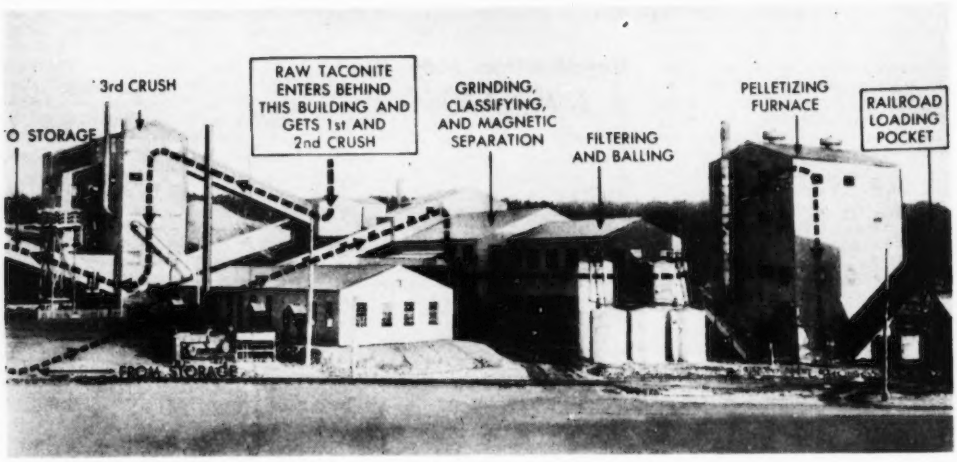
Average weekly hours worked also dropped. In copper mines from 46.3 hours in April to 39.7 hours in July. In lead and zinc mines, from 43.1 hours in March to 40 hours in July.

Through mid-July, the production rate (compared with the 1948 averages) had dropped 17% for copper, 18% for lead and 26% for zinc. About 7,600 workers had been laid off. Some 30 mines outside the Tri-State area had closed and the Tri-State itself was producing at only 20% of the 1948 rate.

There was some improvement in August. An employment increase of 1.9% from July to August was reported by 67 mines producing three-fourths of the country's copper, lead and zinc. The total gain of 550 workers resulted from an increase of 4.8% in lead and zinc employment while the continued decline in copper was slowed to less than 1%. In fact, more mines reported declines in jobs rather than increases between July and August. But there were more mines with steady employment, and the fewer mines which increased employment outweighed those that cut jobs.

Most copper mines were working a 40-hour week in August, while lead and zinc mines scheduled 48 hours. Two copper mines were running only 32 hours, but no lead or zinc mine was working less than 40 hours. Usually the 40-hour week represented a recent cut-back from 48 hours. Some mines running 48 hours were compensating for drastic cuts in employment.

NEWS OF THE INDUSTRY



TACONITE BENEFICIATION experimental work is being carried on in this preliminary plant of the Erie Mining Co., on the Mesabi Range near Aurora, Ill. Arrow shows course of material through the plant. The plant was put in operation in the summer of 1948.

Taconite Flowsheet At Aurora Is Disclosed

Curiosity as to the flowsheet developed by Erie Mining Co. for its pilot, or preliminary, taconite, beneficiation plant near Aurora, Minn., on the Mesabi range was satisfied to some extent Oct. 13 when the company released a brief description of the treatment process employed. The Erie company is operated by Pickands, Mather & Co. for the account of Bethlehem Steel Co., Youngstown Sheet & Tube Co., Interlake Iron Corp., and themselves.

At the same time, Erie announced that it was applying to the Minnesota Department of Conservation to insure an adequate water supply for the commercial-scale beneficiation plant, or plants, proposed to be erected eventually in the Aurora area. The first commercial-scale plant would have a capacity of 2,500,000 tons of finished product per year, in contrast to the 200,000-ton capacity of the pilot plant. Capacity would be stepped up gradually to a contemplated 10,000,000 tons. However, it should be noted that Elton Hoyt II, Erie's president and senior partner of Pickands, Mather, says that no final decision has as yet been made to build such a commercial-scale plant. The application as to water supply is merely a necessary preliminary. The company seeks permission to establish a reservoir for supplying water at the rate of 12,000 gpm. to the proposed plant or plants. The application asks that, in view of the size of the project, limitations as to the start of construction of dams and other facilities be not less than five years.

Tailings would be disposed of by dumping them on wasteland areas north of the range, already acquired by the company.

According to the description released of the pilot plant flowsheet, taconite of the magnetic variety, after being loaded in the open-pit mine by 4-cu.-yd. electric shovels and trucked to the plant, is crushed in three stages to 6 in., 1½ in. and ⅝ in. respectively and delivered to a 6,000-ton storage bin. It is then ground wet in a 12-ft. rod mill, the waste siliceous material being discarded as quickly as possible. Rod-mill discharge goes to a magnetic cobber, which makes a final tailing. Fine grinding in a 12-ft. ball mill, is followed by magnetic separators which also make a rejected tailing.

The magnetic concentrate goes to a spiral classifier which overflows at 100 mesh, the sands returning to the ball mill for regrinding. Siliceous particles remaining in the minus-100-mesh classifier overflow are removed by a final stage of magnetic separation. The finished concentrate, running 63-65% iron, represents about one-third of the original feed. It is dewatered on a filter to 10%.

Efforts to pelletize the fine concentrade as a substitute for sintering are under way. At present, the concentrate is being put through an 8-24-ft. so-called balling drum to emerge as roughly-spherical balls ½ in. to 1½ in. in diameter. These are baked at high temperature in a vertical pelletizing furnace, changing in the process from magnetite to hematite. The finished pellets must be strong enough to withstand subsequent handling, during shipment and at the furnace.

Oil-Shale Demonstration

U. S. Bureau of Mines Oil-Shale mining demonstration held near Rifle, Colo., Sept. 20-21, attracted more than 450 visitors and technical observers, predominantly oil men. E. M. Sipprelle, acting chief in the Oil-Shale Branch estimated that a four-week test run started Sept. 7 would end with direct mining costs of 26 to 28c. per ton and over-all costs of 60c. Previous tests resulted in costs of 32.9c.

Opinion was virtually unanimous that the Bureau has done an outstanding job in mine research as evidenced by the exceptionally low costs achieved. It was estimated, however, that direct mining costs might be about 25c. higher per ton for private industry under similar conditions.

Many oil men present concluded that liquid fuels could be produced more cheaply from materials other than shale on the basis of present prices. But from a long-range viewpoint, it was conceded that we should be looking into all sources of liquid fuels now, and that a change in the world peace outlook could very well precipitate intense interest in oil shale. The pioneering work of the Bureau, the Union Oil Co. and Standard Oil Co. of N. J. in the production and refining of oil from shale was regarded as highly essential at this time.

High Spots in A.M.C. Convention Include Sessions on Public Lands, Subsidies, Drill Bits

General sessions of the American Mining Congress, Western Division, held in Spokane, Sept. 26-28, proved to be a good sounding board for controversial views on public land policies, labor, and subsidies. Little division of opinion was in evidence on tax and gold policies. Technical sessions were well attended—in fact loudspeakers were used to reach the overflow audience at a symposium covering insert bits and single-pass bits.

Labor

Speakers at the labor session under chairmanship of Louis Buchman, general manager, Utah Copper Division, Kennecott Copper Corp., were surprisingly forthright. James K. Richardson, speaking for himself, and not for the Utah Mining Association of which he is manager, said that it was disheartening "to see various operations under dubious subterfuges, bypass and nullify portions" of the Taft-Hartley Act. He referred to the actual existence of closed shops despite legal prohibition, and to the practice of bargaining with unions who fail to observe non-Communist affidavit provisions of the Taft-Hartley Act. By-passing these legal restrictions, he said, may have given "moral sanction to the President in his callous disregard of the measure's terms with his appointment of a 'Fact-Finding Board' to consider steel's labor problem."

Speaking extemporaneously, Howard Young, President of the American Mining Congress, said that he was disappointed that a large segment of the mining industry is dealing with unions lead by Communists, and failed to take advantage of the provisions of the law enabling it to deal with these unions.

Herman W. Steinkraus, president of the U. S. Chamber of Commerce, told members of the convention attending the welcoming luncheon that three primary factors are in evidence wherever good labor relationships exist: 1. Management has respect for workers as human beings, and this is evinced by a friendly attitude toward the men. 2. A strong effective bargaining team is established on the local level without outside interference on either side ("Bargain with your own people in your own plant" he said "and don't call in someone else for help.") 3. Management plans ahead in matters of employee-relations just as it does for production.

Public Lands

Marion Clawson, director, Bureau of Land Management, presented a well-documented paper recommending revision of United States Mining Laws at a session on Public Lands at which Evan Just, director, Strategic Materials Division, ECA, presided. Among the provisions recommended for study were: a new section in the law calling for rectangular 40-acre mining claims instead of present lode claims; the abolition of extralateral rights on *new* mining claims; a section providing for the staking of geological mining claims; the recording of unpatented mining claims with the Bureau of Land Management; and the filing of annual assessment records with Bureau of Land Management.

Mr. Clawson recommended that the proposed draft be considered carefully and changes be made slowly. He called attention to the immense demand for public lands for many purposes which has increased about 25% in the last year and reminded listeners that there are about 5,000 public land laws to be administered of which 100 are of major importance.

Charles F. Willis, secretary, Arizona Small Mine Operators Association, reported the industry viewpoint on the proposed changes in mining laws. His paper contained the essence of an exhaustive survey of opinion. Geological and geophysical claims were supported, but specific provisions pertaining to proposed changes were controversial. An increase of annual assessment requirements from $100 to $300 or more was opposed, particularly because taxes are already too burdensome for prospectors and miners. The industry requested greater speed in patenting claims. Filing of duplicate location notices with the Department of Interior was opposed, but it was conceded that county recording offices in in all states should establish more uniform requirements. Present confusion which exists concerning ownership of unpatented claims was ascribed to moratoria on assessment work, which the industry considered detrimental. The Hoover Task Force recommendation for vertical boundaries and the abolition of extralateral rights on *new* claims gained no support on the grounds that such changes would create great confusion in mining titles. The industry denounced the location of invalid claims for purposes other than mining, concluding that provisions of present laws can prevent such abuses. The separation of surface and underground mineral rights was vigorously opposed. General conclusion was for the preservation of present laws.

Horace M. Albright, president, U. S. Potash Co., said that he did not advocate extension of the leasing system at present but pointed to the progress of the oil, coal and potash industries as examples of what can be accomplished under this system by free enterprise. He urged consideration of the advantages of the leasing system and suggested under fair administration it could prove equally attractive producers of minerals not now covered by leasing.

Resolutions presented by the American Mining Congress committee at the conclusion of the meeting gave little evidence of a desire to change the status quo. Disappointment was expressed from the floor that the resolutions failed to endorse geological and geophysical claims at present.

Incentives

Henry B. Fernald of the American Mining Congress Tax Committee, and E. H. Snyder, president of Combined Metals Reduction Co., were co-chairmen of the session on taxes, incentives, and stockpiling. The "pro" side for exploration and production incentives was presented by A. E. Peterman, vice president, Calumet & Hecla Consolidated Copper Co., Calumet, Mich., who pointed out that stockpiling and tariffs are not adequate to assure ample supply of nonferrous metals within our border in the event of international strife. Our only safety lies in maintaining adequate current production, he said, in urging measures to encourage increased exploration and continued production of marginal ores.

W. C. Page, assistant general manager, Western Operations, U. S. Smelting Co., presented evidence to show that production and exploration incentives "are merely palliatives which would subject those receiving such assistance to substantial bureaucratic control." Consequently he suggested that the mining industry concentrate on tax revision as the soundest method of obtaining equitable long-term benefits.

Dr. James Boyd, director, U. S. Bureau of Mines, prefaced his remarks on exploration and production incentives with this remark: "The administration is not interested in entering the mining industry, and has no desire to control mineral production." Dr. Boyd said if S.2105 does not depart from the basic principles agreed upon in conferences between congressional representatives and various executive agencies, "the bill is likely to receive Presidential approval" when and if it is passed.

Milling Session

Three interesting papers were presented during the milling session. J. J. Burns in describing improved flotation resulting from changed crushing plant design stated that the new Balmat crushing plant reduces 10-in. mine ore to ¼ in. in two stages, with an increase in crushing rate from 125 tons to 170 tons per hr. Product from the plant has 0.3% + 3 mesh and 66% —8 mesh. Delays in mine hoisting schedule have been eliminated, and connected horsepower to the new crushers has been reduced 23% below that of the old crushers and welding reduced from two full

time welders to one part-time welder.

Nathaniel Herz, chief metallurgist, Homestake Mining Co., after tracing developments in milling during recent years suggested some of our more difficult ores might be processed by making a new easily milled synthetic ore out of a low-grade rough concentrate. International Nickel, for example, is using flotation on a synthetic ore—a nickel-copper matte is cooled under controlled conditions, milled by grinding, metallic particles removed magnetically, and the nickel and copper sulphides separated by preferential flotation, he stated.

The new sink-float plant placed recently in operation at Cominco's concentrator at Chapman Camp, B. C., was described by H. R. Banks. To date the plant using galena medium has treated some 1,000,000 tons of feed, and has yielded results definitely comparable with the test work done prior to its installation.

Stockpiling

Major General A. B. Quinton, acting director for industrial programs of the Munitions Board review, presented progress in stockpiling. Pointing out that only 27 materials of the 69 required are produced in the United States, he said "We consider it to be our duty under the Act and in the interest of national security, to stockpile principally those materials produced abroad."

Strategic Metals

Referring chiefly to antimony, tungsten and mercury, James P. Bradley's paper on the "Status of the Strategic Metals" concluded that the cutting of tariffs and other actions of the Government favorable to foreign producers had been discouraging to domestic strategic metal miners. Tariff cuts on antimony created conditions which would not at present justify the antimony smelter now in operation at the Yellow Pine mine if it were not for the gold content of the ores.

Open-Pit Mining

Alfred T. Barr described the recently modernized rail haulage system at the Ajo pit of Phelps Dodge Corp. and use of new trolley-electric locomotives equipped with 325-hp. diesel engines which furnish power for operation over bench tracks in the pit and other non-electrified tracks in the haulage system. Use of these units has eliminated the necessity for electrifying some 23 miles of track, and avoided operating difficulties which would have attended complete electrification of the haulage system. A complete haulage cycle for the locomotives serving an ore shovel on the 1,500-ft. level of the pit is accomplished in 68 min.

Pointing out that larger drills with their heavy string of tools can drill a 12-in. churn drill hole at the same rate of speed that the lighter drills can drill a 9-in. hole, G. J. Ballmer in his paper on drilling and blasting 12-in. holes at the Chino pit of Kennecott Copper Corp. also described early experimental work with the larger bits and comparisons between the 9-in. and 12-in. holes. Tons blasted per lb. of powder is 4.80 and 4.60 respectively for the 9-in. and 12-in. holes; tons blasted per ft. drilled, 41.64 and 67.90; and ratio toe-to-bank height, 0.785 and 0.861. By using 12-in. holes with their greater toe load and greater backbreak, it is possible to drill and blast a greater depth of bench with 7 rows of holes than is ordinarily possible with 8 rows of 9-in. holes. Bench heights in the pit are 40 and 50 ft.

Use of underground belt conveyors at the property of Potash Company of America was ably discussed by E. Russell Haworth, assistant general manager. Belts have proven superior to locomotive haulage where steep grades are encountered, and they are of advantage where ore is less than 6 ft. thick, since much handling of waste can be eliminated.

Improvements in Mining

Diesel power mechanization underground was the subject discussed by S. S. Clarke, general superintendent of mines, Eagle-Picher Mining and Smelting Co. In addition to describing improvements made on diesels used to reduce carbon monoxide to a minimum, Mr. Clarke revealed that the average cost per ton of 18 operating mines using all type of haulage, trucks (diesel and battery), battery locomotives, tail-rope haulage, incline haulage, for a given time totaled $0.341; that of four mines having both diesel and battery trucks, $0.224; and four mines on diesels, $0.251. One mine that has had diesels the longest shows a cost of $0.185, due to well-kept roads and experienced drivers.

Work of sinking the 1,100-ft. incline auxiliary shaft, and design and construction of the mechanical mucking unit (E&MJ, Aug., 1949) used at the mine of Bunker Hill & Sullivan Min. and Conc. Co. were described by Stanley W. McDougall and J. E. Gordon. The shaft was completed in 193 days; average progress per 24-hr. day, 5.7 ft.; average progress per month, 171 ft.; and total cost per ft., $167.96.

The symposium on insert bits and single pass bits drew a record attendance. J. J. Curzon in describing experience with insert bits at Holden stated that since the use of 2-in. tungsten-carbide bits for long holes began in July, 1948, a total of 72,027 ft. of drilling has been done by 647 bits for an average of 113.2 ft. per bit. Of this total of 647 new bits issued, 205 were removed from the circuit because of failure of one insert. One hundred of these bits have been returned to the circuit and the remaining 105 will be used up gradually. Thus, the to-date factor of 113.2 ft. per bit should be increased as additional footage is obtained from bits formerly discarded. Also, new bits are now averaging 120 ft. or more before failing.

C. J. Abrams reported results obtained with tungsten insert Carset bits used on drifters at Climax. The 3½-in. drills used have aluminum shells with 4-ft. feed, and steel is 1¼ in. At present the company averages 485 ft. per bit, and is able to drill out a 10x14-ft. heading in 45 min. Alloy rod and studs were used but the studs gave considerable trouble, causing 68% of all steel difficulties. The use of straight carbon rod (threaded with a 115 thread) was then resumed with the result that about 64% of the steel breakage occurred in the shanks. Mr. Abrams reported that alloy rod gave 116 ft., whereas carbon rod gave 170 ft. It was cheaper to use threaded carbon steel. Direct steel costs were 3.1c. for bits and 3.3c. for steel, totaling 6.4 c. per ft. of hole drilled.

R. S. Hooper, J. C. McIntosh, and G. L. Craig took part in the discussion covering single-pass bits, principally the "Throw Away," Craig and Liddicoat bits. Citing the Calumet and Hecla properties, where under normal operating conditions from 300,000 to 350,000 ft. are drilled per month, Mr. Craig said that the cost per bit use for all mines prior to the adoption of the Liddicoat bit was just over 9c., or about ½c. per ft. of hole drilled. The adoption of the Liddicoat bit increased the footage per miner shift from 80 to 90 ft.—about 12½%; and the footage drilled per bit use increased from 4½ to 13 ft.—or about 300%. Resulting bit cost per foot of hole was 1c.—a decrease of more than 50% on average.

Mr. Hooper disclosed that the "Throw Away" bit has distinct advantages in a very large percentage of the drilling that is to be done on the Bunker Hill mine, and that it is especially suited to the medium hard, very abrasive quartzites that predominate in the mine development work. Good results have also been obtained in the stopes where the vein filling is composed of galena, quartz, and sometimes siderite. Cost per bit is $0.15; feet per use, 12.4; and cost per ft. of hole $0.0121.

Craig bits, Mr. McIntosh stated, have been used exclusively at the Zincton property of Sheep Creek Gold Mines, Ltd., for seven years and for two years at Sheep Creek. At the Sheep Creek property where narrow veins, mainly glassy quartz in a country rock of hard, white quartzite, are mined, bit life is 1.17 ft. and rod life 16.2 ft. Average rock penetration is 6.7 in. per min. In the replacement deposit of sulphides in limestone (very little quartz) the figures are 7.32 ft. and 155 ft. respectively. Average rock penetration is 22.2 in. per min. Average cost per bit handled at Sheep Creek, B. C., has been 11.79c.

MARKETS—Trends and Prices *(Continued from page 69)*

Refined Lead Production, by Countries

(American Bureau of Metal Statistics)

The following accounting is essentially on the basis of primary refineries and includes both soft and hard lead. Figures in short tons.

	April	May	June	July	August	Sept.
United States	50,150	51,605	46,429	39,282	39,362	36,103
Canada	10,372	12,836	12,996	7,022	14,816	14,580
Mexico	14,108	21,918	21,302	25,795	21,598	20,641
Argentina	1,738	1,235	1,842	1,808	2,238	2,155
Peru	3,379	3,433	3,386	3,350	3,337	3,023
Belgium (a)	6,502	6,249	6,003	6,584	.....	.....
France	4,162	4,762	4,050	1,400	2,651	.....
Germany (Br. zone)	7,988	7,421	7,510	7,983	.....	.....
Italy	1,931	2,392	4,031	1,270	848	.....
Spain	1,264	1,605	1,487	1,748	4,458	.....
Japan	1,290	1,219	1,230	1,107	1,172	.....
Australia (b)	15,213	20,446	21,362	(c)6,299	(c)8,924	.....
Tunis	2,735	2,249	1,873	1,124	869	.....
Rhodesia	1,260	1,316	1,299	1,434	1,344	1,288
Totals	122,092	138,686	134,800	106,206	.....	.....

(a) Reported as three months' moving averages. (b) Includes lead refined in England from Australian base bullion. (c) Refinery closed down from July 8 to August 23, owing to coal strike.

Official London Prices

Since Dec. 18, 1939, the British Ministry of Supply has named maximum delivered prices for the major nonferrous metals. Delivered prices for lead and zinc were lowered during October, 1949, following the decline in the U. S. market.

	Per Long Ton		
	£	s.	d.
COPPER:			
Electrolytic, high conductivity	140	0	0
Fire refined, high conductivity	140	0	0
Fire refined, high grade	139	10	0
Fire refined, min. 99.7 percent	139	0	0
Fire refined, min. 99.2 percent	138	10	0
Hot rolled black wire rods	146	0	0
LEAD:			
Soft, foreign, duty paid	105	0	0
Soft, Empire	105	0	0
English, refined	106	10	0
ZINC:			
Foreign (G.o.b.) duty paid	83	10	0
Domestic (G.o.b.)	83	10	0
Prime Western and debased	83	10	0
Refined and electrolytic	84	5	0
Minimum 99.99 percent	85	15	0
TIN:			
Ingot, 99 percent	750	0	0

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipment, f.o.b. New York unless otherwise stated

MISCELLANEOUS METALS

(October 31, 1949)

Aluminum, ingot, 99 plus percent, lb. (base price)	17c.
Antimony, spot, lb., 5 tons and up but less than carload, in cases	25.28c.
Bismuth, ton lots, lb.	$2.00
Cadmium, commercial sticks, delivered, lb.	$2.00
Calcium, lb., ton lots, 98 percent, cast	$2.05
Chromium, 97 percent grade, lb., contract	$1.97
Cobalt, 97 to 99 percent, per lb.	$1.86
Indium, troy oz.	$2.25
Nickel, cathodes, lb., f.o.b. Port Colborne (a)	40c.
Magnesium, 99.8 percent, carloads, lb., producer's plant	20½c.
Palladium, troy oz.	$24.00
Platinum (Official quotation wholesale lots), troy oz.	$69.00
Quicksilver, flask of 76 lbs., 25 flasks or more	$73.00
Selenium, 99.5 percent, lb.	$2.00
Silicon, minimum 97 percent, spot, carloads, lb.	16.50c.
Tellurium, lb.	$1.75 nom.
Thallium, 100 lb. or more, lb.	$15.00
Titanium, 96 to 98 percent, lb.	$5.00

(a) Includes U. S. duty

METALLIC ORES

Beryllium Ore, imported, 10 to 12% BeO, per unit	$25.00@$30.00
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry	
48% Cr_2O_3, 2.8 to 1 ratio	$35.00
48% Cr_2O_3, 3 to 1 ratio	$37.50@$39.50
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	**$7.60**
Mesabi bessemer	**$7.35**
Old Range non-bessemer	$7.45
Mesabi, non-bessemer	$7.20
Lead (Galena), 80 percent, Joplin, Mo., ton	$16.97
Manganese Ore—Per long ton unit of Mn basis 48 percent manganese subject to premiums and penalties, 78@80c., c.i.f. U. S. ports. Quoted prices largely nominal.	
Molybdenum Ore, 90% per lb. of MoS_2 f.o.b. mines	54c.
Tantalite, 60% concentrate, per lb.	$2.00@$2.75
Tungsten Ore, per unit of WO_3	
Foreign, 60 percent, duty paid (a)	$18.50@$19.50
Domestic, scheelite, 60 percent and upward	$28.50
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines	27½c.
Zinc Ore, Prime, 60 percent concentrate, Joplin, Mo., per ton	$53.00

(a) Nominal

METALLIC COMPOUNDS

Arsenious Oxide (arsenic trioxide) lb., in bbl. carload lots, delivered	5½c.
Cobalt Oxide, 70 to 71 percent, lb., ceramic grade	$1.38@$1.40½
Copper Sulphate, 100 lb.	$7.00

ALLOYS

Beryllium Copper, 4 percent Be, per lb. of contained Be	$24.50
Ferrochrome, 65 to 69 percent, per lb. of Cr contained	18.60c.
Ferromanganese, 78 to 82 percent, gross ton, seaboard	$172.00
Ferromolybdenum, 55 to 65 percent Mo, lb. of Mo, contained	$1.10
Ferrosilicon, 50 percent, per lb. of contained Si	11.3c.
Ferrotungsten, 75 to 80 percent, lb. of W contained	$2.25
Ferrovanadium, per lb. of V delivered	$2.99
Silicomanganese, 1½ percent C, per lb. contracts	8.6c.
Spiegeleisen, per long ton, 19@21%	$65.00

NON-METALLIC MINERALS

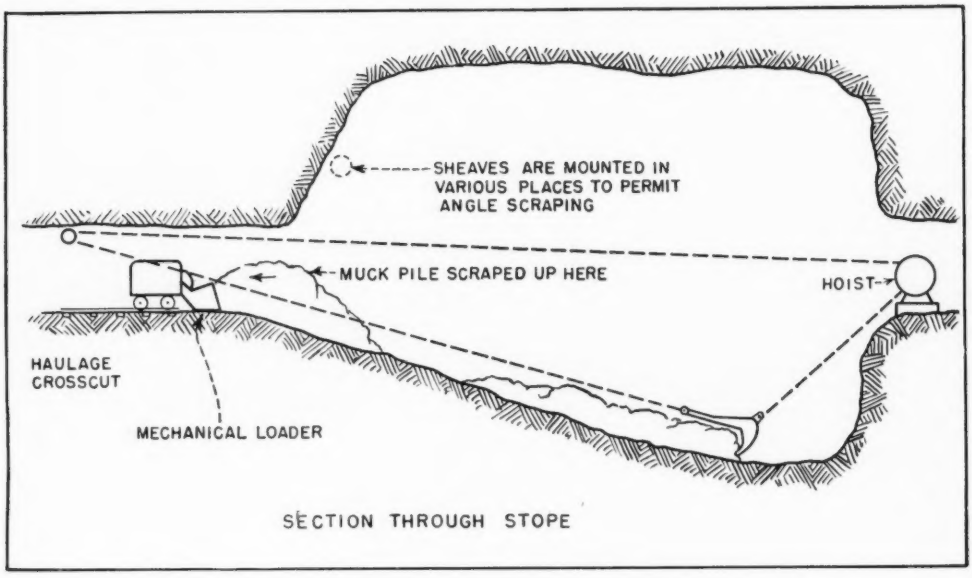
Asbestos, f.o.b. Canada (Quebec) mines (U. S. funds), ton:	
Crude No. 1	$960@$1,050
Crude No. 2	$492@$550
Spinning fibers	$232@$475
Shingle fibers	$95.50@$141
Paper stock	$78.50@$88
Waste	$58
Shorts	$27@$52
Vermont, f.o.b. Hyde Park	
Shingle stock	$97.00@$107.00
Paper stock	$68.50@$85.00
Waste	$51.00
Refuse or shorts	$25.50@$46.50
Barytes, f.o.b. mines:	
Georgia, crude, per long ton	$11.50@$12.00
Missouri, 93 to 94 percent $BaSO_4$, per short ton	$9.00@$9.50
Bauxite, long ton:	
Domestic, crude, 50 to 52 percent (not dried)	$4.00@$5.00
Domestic, chemical, 55 to 58 percent	(a)$8.50@$9.50
Domestic, abrasive, 80 to 84 percent	$18.00@$18.50
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, airfloated bulk	$8.50@$9.50
North Carolina, ceramic grade	$18.00@$20.00
Feldspar, bulk ton:	
Potash or soda feldspar, 200 mesh	$18.50
Glass spar, white, 20 mesh	$11.75@$12.50
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois, 70% effective, CaF_2, ton	$37.00
Acid 97% concentrate, bulk, ton	**$43.50**
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington	$30.50@$31.00
Mica—Domestic f.o.b. mines, Punch, 12 to 22c. per lb. according to size and quality. Sheet, clear, 1½ x 2 inch, 70 to 75c.; 2 x 2 inch, $1.10 to $1.20; 2 x 3 inch, $1.40@$1.50; 3 x 3 inch, $1.70@$1.80; 3 x 4 inch, $2.10; 3 x 5 inch, $2.40; 4 x 6 inch, $3.15; 6 x 8 inch, $4.25. Wet ground, very fine, $155@$165 per ton. Bulk sales, dry ground, $40@$80 per ton. Scrap, $21 and up.	
Ocher, Georgia, ton, in sacks	$24.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	(a)12@14c.
Sulphur, Texas, mines, long ton	$18.00
Talc, f.o.b. works, ton:	
New York, purified	$18.50@$20.00
Vermont, extra white	$12.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$14.50

(a) Nominal

IRON AND STEEL

Pig iron, gross ton, basic, Valley furnaces	$46.00
Steel, f.o.b., Pittsburgh billets, net ton	$52.00
Structural shapes, 100 lb.	$3.25

OPERATING IDEAS



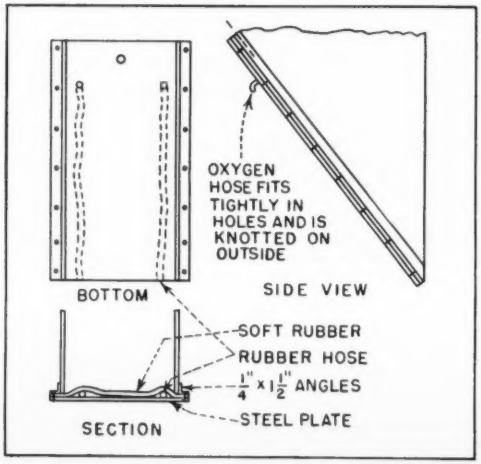
Scraper and Shovel Operate Together in Stope

The versatility of mechanical loading equipment may often be increased by using combinations of two types such as the scraper and the shovel loader. The units shown above were used to clean out a stope below drift level which connected to a haulage crosscut at a Western base-metal mine. First angle scraping was employed to move muck from various parts of the stope to the mouth of the crosscut. At this point a mechanical shovel picked up the muck and transferred it to mine cars which hauled it to the skip pocket of the shaft. Tail sheaves were mounted in various places in the stope to permit angle scraping.

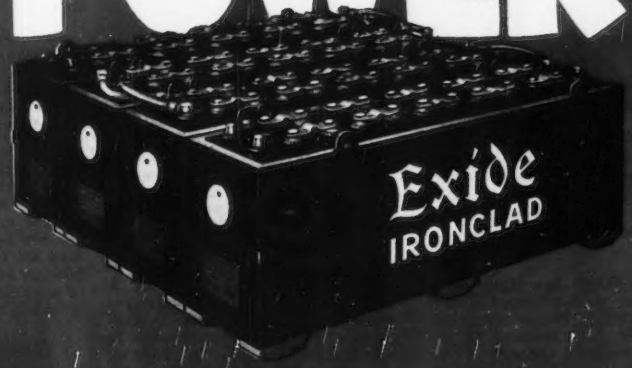
Soft Rubber Chute Bottom Prevents Hang-Ups

After concentrates persistently hung up in a 51-deg. steel chute feeding a 9x14-ft. filter at Benson Mines, New York State, W. A. Vickers, general foreman of the concentrator devised the rubber-lined chute bottom shown here to solve the problem.

A new steel bottom, covered with soft rubber, was bolted on $\frac{1}{4}$x2-in. angles welded on the steel chute as shown. The rubber, however, was not bolted to the bottom of the plate at the lower end of the chute. Six inches from the top edge of the steel bottom an air connection was welded on. In addition two pieces of rubber oxygen hose were inserted between the rubber cover and the bottom plate, spaced 2 in. from the sides as shown. These prevent the rubber from lying "dead" against the chute bottom. Air forced down between the steel bottom and the rubber cover causes the rubber cover to vibrate gently and dislodge the concentrates.



SAFE DEPENDABLE POWER



On the job...all day long... battery powered haulage units and

EXIDE-IRONCLAD BATTERIES

Exide-Ironclad Batteries are different in CONSTRUCTION . . . in PERFORMANCE. The difference is due chiefly to the unique positive plate. The result is a battery that assures peak performance with full shift availability and many extra months of service.

Exide-Ironclad Batteries have ALL FOUR of the characteristics that a storage battery must have to assure maximum performance from mine locomotives, trammers and shuttle cars—high power ability, high electrical efficiency, ruggedness and a long life with minimum maintenance. The combination of these Exide-Ironclad characteristics assures years of day-in, day-out service with dependability and economy.

1888...DEPENDABLE BATTERIES FOR 61 YEARS...1949

"Exide-Ironclad" *Reg. Trade-mark U. S. Pat. Off.*

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32 • *Exide Batteries of Canada, Limited, Toronto*

PERSONAL NEWS

ELECTED RECENTLY by the Board of Directors of Climax Molybdenum Co. were H. J. Szold, general partner of Lehman Brothers, as a director; William J. Coulter, manager of mining operations for the company since 1934, a vice president in charge of mining operations; and Weston Gage Thomas, formerly vice president of the board of the Potash Corporation of America, treasurer.

Herbert Z. Stuart has been named chief engineer of the Copper Queen branch of Phelps Dodge Corp. at Douglas, Ariz. He replaces **H. H. Schou**, who resigned recently. **A. T. Barr**, formerly mine superintendent at the New Cornelia division at Ajo, was named general superintendent. **J. A. Lentz** succeeds him.

Carl T. Ulrich, vice president and treasurer, Kennecott Copper Corp., has been named chief executive officer until such time as a president to succeed the late **E. T. Stannard** has been elected.

WILLIAM L. McKNIGHT, president of Minnesota Mining & Manufacturing Co. since 1929, has been elected to the newly created post of chairman of the board. Archibald G. Bush, former executive vice president, and director of marketing and distribution, becomes chairman of the executive committee.

C. A. Botsford, mining engineer, returned late in May after completing a tour of duty of 27 months as chief of the Minerals Branch, Mining & Geology Division, Natural Resources Section at Gen. MacArthur's headquarters. He spent three months in California and the Canadian Rockies, and on Sept. 28 left New York for Calcutta, en route to Siam and Burma, to act as consultant for New York industrialists interested in tin, tungsten and lead mining. Before going to Tokyo, Mr. Botsford served the Department of State as Minerals Attache at Havana, Cuba, and Rome, Italy, from January, 1943, to October, 1946. Prior to that time he spent 18 years mining in Mexico and Venezuela.

Robert H. Raring, vice president and general manager of the Copper Canyon Mining Co., visited the New York office of the company during the week of Sept. 26. He reported to the directors and stockholders, developments and plans of the company for the ensuing year.

Russell C. Clark, vice president of the Tin Sales Corp., agent for Reconstruction Finance Corp. since formation of the company in April, 1943, resigned Sept. 30. He will open a New York office for Nathan Trotter & Co., metal merchants, of Philadelphia, for the purpose of conducting a brokerage business in metals. Mr. Clark was an officer and director of C. S. Trench & Co., Inc., from 1930 to 1941. During 1942 he was New York representative of the tin, lead and antimony section of O.P.A. During the last six years he has superintended the distribution of tin owned by RFC.

James M. Hill, mining geologist and mineral economist, has opened a consulting office at 182 North Court St., Tucson, Ariz. He has formerly with the U. S. Geological Survey and Union Carbide and Carbon Corp.

James R. Sweet was elected vice president and general manager of Tungsten Mining Corp. at a meeting of the board of directors on Sept. 12. He is in full charge of the company's operation of the Hamne tungsten mine in Vance County, North Carolina.

Dr. Paul D. Merica, executive vice president of the International Nickel Company of Canada, Ltd., was elected a director of The Babcock & Wilcox Co. on Sept. 22.

Walter G. Hay has been appointed superintendent of the rod and wire mill at the Great Falls Reduction Works, Anaconda Copper Mining Co. **Thomas K. Graham** has been appointed assistant superintendent of the electrolytical zinc plant to succeed **Dr. George J. Gruenfelder**, who recently resigned to become professor of metallurgy at the Montana School of Mines, Butte.

RICHARD P. CARLTON, former vice president in charge of research, has been named to succeed William L. McKnight as president of Minnesota Mining & Manufacturing Co. George H. Halpin, former vice president for sales, has been named executive vice president and will continue to direct sales activities. Herbert P. Buetow, treasurer since 1939, becomes executive vice president in charge of finance.

C. K. Lenz has been elected president and sales manager of Kennecott Sales Corp., succeeding **C. T. Ulrich**, who was recently appointed chief executive officer of Kennecott Copper Corp. Mr. Ulrich will continue as a director of Kennecott Sales. **S. S. Jackson** was elected vice president of the sales corporation and **H. E. Westlake**, vice president and assistant sales manager.

R. J. Nekervis has been appointed supervisor of metallurgical develop-

For STEEL in a hurry

Call RYERSON

Wherever you are in America, there's a well stocked Ryerson steel plant within quick shipping distance. From thirteen strategically located points, Ryerson carbon, stainless and alloy steels in thousands of kinds, shapes and sizes are ready for immediate delivery.

By carefully specifying and checking, we are able to certify to the consistently uniform high quality of our steels. And to help you select the type best suited to the job at hand, the services of experienced Ryerson specialists are always yours for the asking.

Widely diversified Ryerson stocks enable you to procure many steel requirements at the same time from the same source. One order—one invoice does the job. So save time, save paperwork and be sure of uniform quality. Call Ryerson when you need steel.

PRINCIPAL PRODUCTS

BARS—Carbon & alloy, hot rolled & cold finished

SHAFTING—Cold finished, ground and polished, etc.

STRUCTURALS—Channels, angles, beams, etc.

TUBING—Seamless & welded mechanical & boiler tubes

STAINLESS—Allegheny plates, sheets, bars, tubing, etc.

PLATES—Sheared & U. M., Inland 4-Way Floor Plate

SHEETS—Hot & cold rolled, many types & coatings

MACHINERY & TOOLS—For metal working

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON
PHILADELPHIA • DETROIT • CINCINNATI • CLEVELAND • PITTSBURGH • BUFFALO
CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO

RYERSON CERTIFIED STEELS

RYERSON STEEL

ment and **R. M. MacIntosh**, supervisor of chemical development, of the newly-formed Tin Research Institute, Inc. The corporation, located in Columbus, Ohio, has been organized to provide free technical service to users of tin in the United States. Both appointees have been with the Battelle Memorial Institute for the past eight years.

L. A. Smith, commercial manager for Andes Copper Mining Co., has been made business manager for Chile Exploration Co. **F. E. Libenow**, has been appointed business manager for Andes Copper Mining Co.

Alexander A. Fischback, Jr., has been made district engineer for the surface water branch, Water Resources Division at Charleston, W. Va., for the U. S. Geological Survey. He succeeds **J. I. Perrey. Lawrence C. Crawford** has been named district engineer at Columbus, Ohio; **Vernal R. Bennion**, district engineer at Iowa City, Iowa, and **Floyd F. LeFever**, district engineer at College Park, Md.

LOUIS BUCHMAN, general manager of Kennecott Copper Corp.'s Utah Division, has recently been appointed general manager, Western Mining Divisions. From his headquarters in Salt Lake City, he will now supervise operations at the Utah Copper Division's mines and mills at Bingham, Magna and Garfield, at the Chino Mines Division in New Mexico, the Ray Mines Division in Arizona, and the Nevada Mines Division of the company. Mr. Buchman, who has served 35 years with Kennecott and its predecessor in the Bingham region, Utah Copper Co., was named general manager of the Utah Division at the start of 1949.

Reed F. Welch has been appointed manager of the Tucson ore-buying office of the southwestern smelting department, American Smelting & Refining Co. He has been ore buyer in the Salt Lake City office of the company since 1937. Mr. Welch succeeds **Brent N. Rickard**, who is retiring due to a recent illness, but will remain in an advisory capacity until July, 1950.

Secretary of the Interior **J. A. Krug** was awarded an honorary degree of Doctor of Engineering from the Colorado School of Mines, at Golden, Colo., on Sept. 29, at exercises held in connection with the college's 75th anniversary celebration.

A. F. Heather has been made mine superintendent at the Howe Sound Exploration Co., Ltd., Snow Lake, Manitoba. **J. S. Roper** was recently transferred from the Britannia Mining & Smelting Co., Ltd., to Snow Lake as chief engineer, and **H. R. Fowlie** has been made mine foreman.

Stephen M. Shelton has been appointed regional director of the Northwest region of the U. S. Bureau of Mines. Known as Region II, this area includes Washington, Oregon, Idaho and Montana, with headquarters at Albany, Ore. He formerly served as chief of the metallurgical branch of the Bureau at Albany, Ore.

Paul Zinner, chief of the Minneapolis Mining Branch of the U. S. Bureau of Mines, has been named regional director of the North Central region, known as Region V. This division includes North Dakota, South Dakota, Nebraska, Minnesota, Iowa, Wisconsin and Michigan, with headquarters at Minneapolis. Mr. Zinner has served in engineering positions at Bureau field offices in Tucson, Ariz., and Rolla, Mo.

Harold P. Greenwald, who has been superintendent of the U. S. Bureau of Mines Central Experiment Station at Pittsburgh for the past 10 years, has been appointed director of Region VIII, or the Northeastern Region, extending from the west boundary of Illinois to Maine and from the Great Lakes to the northern borders of North Carolina and Tennessee.

Joseph H. Hedges, mining engineer and a former assistant to the director of the Bureau of Mines, has been named chief of the new Minerals Division. His headquarters will be in Washington.

Dr. Clifford W. Seibel, supervising engineer of Bureau of Mines helium plants, has been named director of Region VI. Amarillo, Tex., will be headquarters for this region, known as the South Central region, and comprising Kansas, Missouri, Oklahoma, Arkansas, Louisiana and Texas.

John H. East, Jr., engineer in charge of the subdistrict office of the Health and Safety Division of the USBM at Denver, Colo., since 1948, is the regional director of Rocky Mountain area, known as Region IV. With headquarters in Denver, this region covers Wyoming, Utah, Colorado, Arizona and New Mexico.

Sinclair H. Lorain, mining engineer, has been appointed director of USBM's Region I, with headquarters at Juneau, Alaska. Associated with the Bureau since 1936, he has served as district engineer of the Moscow-Idaho, field station, and has been chief of the Albany, Ore., branch of the mining division of the Bureau for nearly five years.

Herbert Hoover, Jr., president of the United Geophysical Co., and a director of Exploration Contractors, spent some time in Fairbanks, Alaska, on business during the fall. His companies are associated with the Arctic Contractors doing Navy research work in the Arctic.

John W. King, mining geologist of Spokane, Wash., who spent three years in Chile and Colombia with the Andes Mining Co., a subsidiary of Anaconda Mining Co., returned to Spokane recently. During his stay in South America, he lived at the company's mining town of Potrerillos.

Samuel F. Dubs, formerly superintendent of the Los Angeles plant of Morris P. Kirk & Son, Inc., subsidiary of National Lead Co., has been appointed chief metallurgist. **W. A. Senter** has been named acting superintendent of the Los Angeles plant.

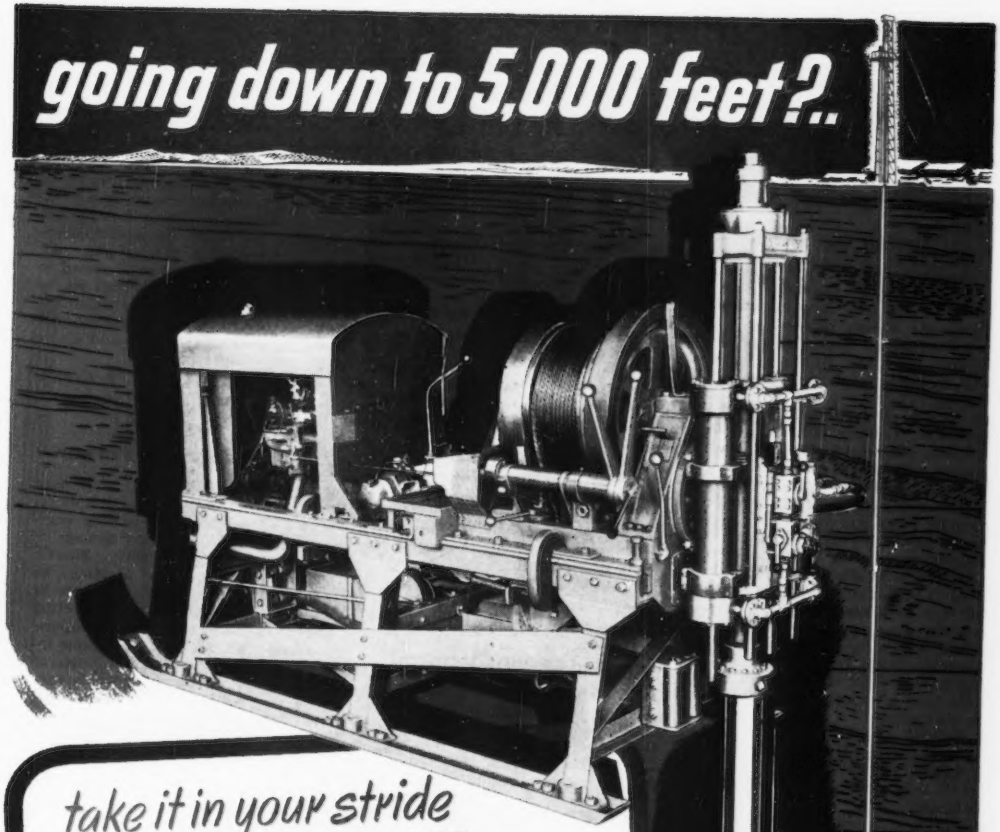
J. E. Riley has retired as secretary of Consolidated Mining & Smelting Co. of Canada, after 34 years of service. He will be succeeded by **L. O. Reid**, who has been assistant secretary since 1937.

J. C. KINNEAR, vice president in charge of operating matters of Kennecott Copper Corp., has been named a director of the company. He was recently elected president of the Nevada Northern Railway Co., succeeding the late E. T. Stannard.

Anton Gray, chief geologist, Kennecott Copper Corp., has been made a vice president of the company. He has also been elected president of Quebec Iron & Titanium Corp. to succeed the late **Russell Parker.**

Lloyd A. Hatch, vice president in charge of the roofing granule division of Minnesota Mining & Manufacturing Co., has been assigned the job of coordinating research and new product development. He has been active in the development and management of the roofing granule division for the past 16 years. **Clarence B. Sampair**, vice president in charge of production since 1946, will have charge of labor relations, and **C. P. Pesek**, vice president in charge of engineering, will now be in charge of all company property.

going down to 5,000 feet?..



take it in your stride with BBS-4...

BBS-4 combines new speed, power and ease of control with traditional Boyles Bros.' dependability and rugged simplicity of design. Ideal for oil or mineral structure drilling, this recently developed surface drill is available with either 80 or 100 H.P. gasoline or diesel engine. Other features include heavy duty 5-speed transmission; optional hydraulic or combination gear and friction feed swivelheads; separate drives to hoist and swivelhead, permitting fully independent operation. BBS-4 is specially designed to take a Kelly drive for rotary drilling.

CAPACITIES:

2000 feet—6 inch hole; 5000 feet—2 $\frac{7}{16}$ inch hole. Maximum hoisting speed—850 feet per minute. Cable drum capacity—300 feet, three-quarter inch. Weight—7800 pounds.

WE LOOK INTO THE EARTH

BOYLES BROS
DRILLING COMPANY LTD.,
VANCOUVER, CANADA

Glenville A. Collins, mining engineer, has recently returned to Santa Barbara, Calif., after spending two months in British Columbia examining uranium deposits. The areas visited included the Hazelton, Molly mine near Salmo, and also some of the Bridge River country on Gunn Creek.

APPRECIATIONS

Arthur D. Storke

A Rare Human—"That is rare . . . of which but few examples . . . are found" (Webster's New International Dictionary, Second Edition).

I find this definition so apt a description of Arthur Storke as to make any enlargement merely repetitious. During his three years as president of Climax Molybdenum Co., I was privileged to have him as my boss. He was competent, firm, uncompromising with wrong, while still a patient, sympathetic friend.

Arthur Ditchfield Storke was born only 55 years ago in Auburn, N. Y., where he had his early education. He studied engineering at Leland Stanford and Colorado Universities from 1912 to 1915, but was unable to finish for lack of funds. He always could, and did, meet any demands for extra effort, no matter how heavy. In his case this meant frequently surmounting intense pain, which was a carry-over from a major stomach operation in his youth.

In 1915 Mr. Storke was connected with the Gold Hill Mining Co., in Colorado, and in 1916 he operated a leased mine at Caribou, Boulder Co., Colorado.

His first connection with Climax was as surveyor and then assistant superintendent from 1916 to 1918. He went overseas during World War I with the 27th U. S. Army Engineers, returning in 1919. From 1919 to 1923 he was, in order, manager of Michigan Colorado Copper Co., Bedrock, Montrose Co., California; a lessor of a mine in Mexico; the manager of the C.O.D. Mines, Inc., Kingman, Ariz., and general superintendent of the Silver Dyke Mining Co., Neihart, Mont. He engaged in independence until 1926.

The upper orebody at the Climax mine ran out in 1925. Storke was most instrumental in discovering, in 1926, while general superintendent, part of the present main orebody. In 1927 he went to Africa to become connected with the Roan Antelope and Mufulira operations. From 1930 to 1943 he was managing director and (from 1938) also vice chairman of Roan Antelope, Mufulira and the Rhodesian Selection Trust, Ltd., with headquarters in London. He was also a director of the American Metal Co., Ltd., from November, 1934, to June, 1949, and of several other corporations.

During World War II Storke was minerals adviser to the British Ministry of Supply, traveling extensively in Africa to expedite the mining of strategic minerals. In 1947 he was decorated by the King of England with the Companion of the Order of St. Michel and St. George for mining development in the Colonial Empire. He was also decorated by Prince Charles, the Regent of Belgium, with Commandeurs de l'Ordre Royal du Lion, for services to the Belgian Congo during the war.

On April 4, 1946, he became a director of the Climax Molybdenum Co., and on July 9, having resigned from his British connection, he became its president. He resigned on June 30, 1949, to prepare himself for the presidency of Kennecott Copper Corp.

Arthur Storke's career belies the charming rationalization in Wilder's "The Bridge of San Luis Rey" in which all those killed when the bridge collapsed were at the end of their tether. *This* man was just about to embark upon that which represents the acme in careers for a mining executive. His untimely death has deeply affected so many—Kennecott has lost a great leader; industry has lost a great engineer; the world has lost a gentleman.

CARL M. LOEB, JR.
New York, N. Y.

Earl Tappan Stannard

Earl Tappan Stannard was born in 1882 at Chittenango, in the State of New York. He attended local schools in that vicinity until his senior year when he matriculated at Andover and the following year entered Yale University. He attended the Sheffield Scientific School there and graduated in the 1905 mining course. He then continued for one additional year in the graduate school.

His first experience after leaving Yale University was with the Federal Lead Co. in Missouri. In 1911 he was employed by the Braden Copper Co. in Chile and for three years was general superintendent of concentrators and, as such, was in charge of both construction and operation of the mills.

In 1914 he left Chile for Alaska, subsequently becoming manager of both the Kennecott and Latouche properties of Kennecott Copper Corp., with general supervision over the railroad which served the mines at Kennecott.

In 1920, he went to Seattle, Washington, as general manager of the Kennecott properties in Alaska, of the Alaska Steamship Co., and of the Copper River and Northwestern Railway Co. In 1923 Mr. Stannard was made vice president of Kennecott Copper Corp. and in 1929 he moved to New York where he also became vice president of Braden Copper Co. and of other subsidiaries. In May, 1933, Mr. Stannard was elected president of Kennecott Copper Corp. and Braden Copper Co., and continued in these positions until the day of his death. He was also, for a number of years, a director of J. P. Morgan & Co., and the Johns-Manville Corp.

In 1936 an honorary degree of Doctor of Engineering was conferred upon him by the Michigan College of Mining and Technology. In 1937 the King of Belgium named him a commander of the Ordre de la Couronne.

Endowed with a keen mind and sound business judgment, he was also possessed of the highest principles and a gracious and charming personality. A man of great energy and capacity for work, he gave unsparingly of his time and efforts. All these admirable qualities combined to make him a wise and effective leader of the corporation and an outstanding personality in the industry, not only in the United States and Chile, but throughout the world.

C. T. ULRICH
New York, N. Y.

Russell Johnson Parker

Russell Johnson Parker was born in Olney Springs, Colorado, and received his education in mining engineering at the Colorado School of Mines, graduating in 1919. Shortly after leaving the School of Mines, he went to the Belgian Congo. There he was engaged in diamond prospecting and production for the Foretminiere.

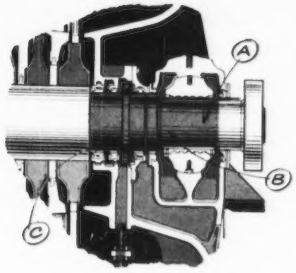
About 1925, Mr. Parker became interested in the copper possibilities of Northern Rhodesia, about which very little was known at that time. He went to London, joined A. Chester Beatty in the Selection Trust, Ltd., and was associated with that group until he came to the United States in 1940. While with the Selection Trust he examined for them the copper prospects of Rhodesia, and it is almost wholly due to his recognition of the possibilities of these deposits that lead the Selection Trust to undertake the developments which resulted in the successful operations now known as the Roan-Antelope and Mufulira mines.

Shortly before the war, Mr. Parker was made managing director of the Consolidated African Selection Trust, and he left his position in 1940 to come to the Kennecott Copper Corp. as assistant to the president. In 1948 he was made a vice president of Kennecott, and put in charge of the Canadian titanium development.

Russell Parker's achievements in his profession, as indicated in this very brief outline, were many, but his greatest achievements were not technical. In Africa, in London, in Colorado, and in New York all the people with whom he worked became and remained his friends. The greatest tribute that has been or can be paid him is the inquiry that has been made wherever he has worked . . . "When is Parker coming back?"

ANTON GRAY
New York, N. Y.

Case 1148B—Reducing Turbine Bearing Wear



TURBINE BEARING

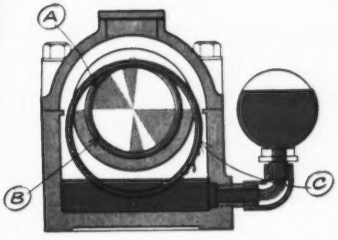
There was no sign of acidity or deterioration in Calol OC Turbine Oil when, after six years use in a heavily-loaded turbine, a sample was given a laboratory analysis. Bearings and other parts showed practically no wear and the entire lubrication system was clean and functioning with maximum efficiency. Recommended for all steam turbine lubrication and as the medium in hydraulic units. There is a grade for every service.

A. Has excellent metal-wetting ability — resists the heaviest bearing and gear loads and assures constant lubrication.

B. Contains a highly effective oxidation inhibitor — prevents the formation of lacquer, gum, and sludge deposits on parts and in oil and hydraulic systems.

C. Corrosion inhibitor stops rusting — Calol OC Turbine Oil in both salt and fresh water tests kept steel strips from rusting while they were immersed in the water-oil mixtures for 48 hours.

Case 1163—Cutting General Bearing Maintenance Costs



RING-OILED BEARING

Specially compounded Calol Red Engine Oil X, used for all general lubrication in lumber mills, cut bearing wear, reduced rebabbitting and replacements 50%, lowered oil consumption 30%, and materially reduced expenses. Recommended for all types of plain bearings. A suitable grade for every service condition.

A. Contains special additives—makes the oil adhere to bearings and moving parts.

B. Provides a tough "oilskin" film that resists heavy loads and high temperatures.

C. Picks up easily on ring oilers...may be applied by all types of oiling systems.

The tenacity of film and high lubricating qualities of Calol Red Engine Oil X reduces consumption, allows less frequent oiling, cuts starting torque and wear, and keeps bearings cooler.

For additional information and the name of your nearest Distributor, write

STANDARD OIL COMPANY OF CALIFORNIA
225 Bush Street, San Francisco 20, California

The California Oil Company
Barber, N. J.—Chicago, Ill.

The California Company
17th and Stout Streets, Denver 1, Colo.

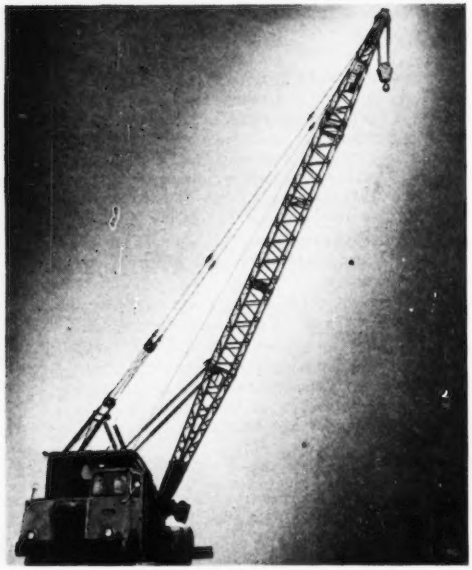
Standard Oil Company of Texas
El Paso, Texas

CALOL

Trademark Reg. U.S. Pat. Office

EQUIPMENT NEWS

Rubber-Tired Crane	122	Copper-Lead Tubing	125	Self-Rotating Electric Hammer	123
Rotary Blast-Hole Drill	122	Fibreglass Safety Hat	126	Sound-Powered Telephones	123
Portable HM Separation Plant	123	Hydraulic Guillotine	126	Tooth Points for Shovels	124
Air Conditioning Unit	123	New Sinker	126	Bulletins	124
Air Couplers	124	Portable Generator	123	Industrial Notes	125



RUBBER-TIRE MOUNTED CRANE with 25-ton capacity, is a self-propelled unit. Crane machinery is powered by separate motor.

Rubber-Tired Crane Has Speed, Flexibility

A new crane has been developed, combining high capacity with the mobility of pneumatic-tire mounting.

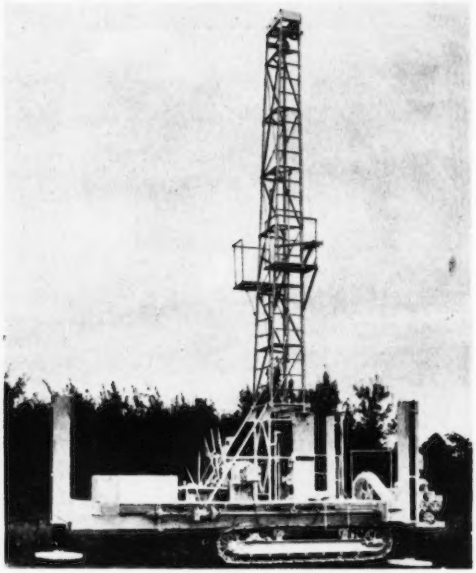
Capacity of the Model 190-T61 Cranemobile is 25 tons. It is mounted on a specially designed, three-axle carrier-powered by a separate heavy duty automotive type gasoline engine, equipped with ten tires and Timken tandem rear axle unit with through worm drive. Main and auxiliary transmission provide 12 forward speeds up to 35 mph. and three reverse speeds.

The crane machinery is powered by a heavy duty 517 cu. in. displacement industrial type gasoline engine. Hoist and auxiliary hoist drums are ball-bearing mounted on separate shafts. Power is transmitted through helical gears and wide external-contracting band type clutches.

The boom is of deep section consisting of basic 30-ft. two-piece pin-connected sections and intermediate 5, 10 and 20-ft. sections. Boom head is equipped with three ball-bearing mounted sheaves, as is the load block, permitting 2, 4, or 6 parts of line. Adjustable jibs are also available in 15 and 30 ft. lengths.

A special load-lowering device is furnished for accurate control of heavy loads instead of relying on the foot break alone.

For further information write Bay City Shovels, Inc., Bay City, Mich.



ROTARY BLAST-HOLE DRILL has 30-ft. folding mast for drilling holes up to 9 in. in diameter to depths of 90 to 100 ft.

Rotary Rig Drills Blast-Holes Faster

Considerable increase in drilling speed with substantial reduction in cost per foot drilled are the chief advantages claimed by the manufacturer for the Sullivan rotary blast-hole drill.

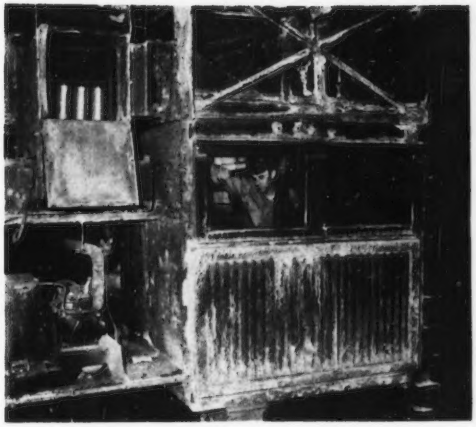
The Sullivan machine is essentially an adaptation of the hydraulic feed, rotary-type drill with roller cone rock bit, so common in the oil fields. The crawler-mounted 56-BH is self propelled. Power is provided by dual gasoline engines, electric motors or diesel engines. The 30-ft. folding mast is equipped with heavy duty sheaves.

Drill pipe consists of 10 and 20-ft. lengths of 4-in. square pipe. The square drill pipe eliminates the need for a special kelly joint. The unit is rated to drill up to 9-in. blast holes to a depth of 100 ft.

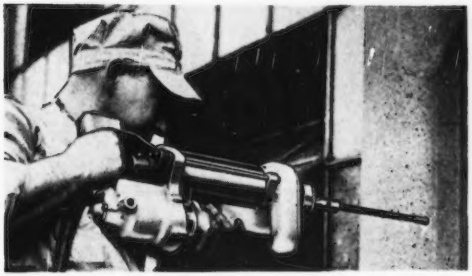
Mechanically actuated and controlled by a single lever, the semi-automatic chuck eliminates hand set-screws and saves the time required to tighten and loosen them. Pressure is applied to the drill pipe and bit by means of twin hydraulic cylinders.

Weight with mast and operating equipment is about 16 tons. Height with the mast down is 10 ft. 9 in. Crawler speed is five miles per hour.

Address inquiries on the Sullivan 56-BH to Joy Manufacturing Co., Oliver Bldg., Pittsburgh 22, Pa.



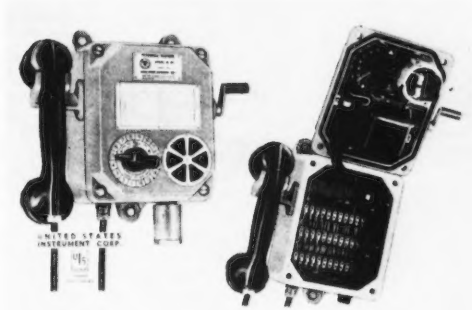
AIR CONDITIONING UNIT at a New Jersey smelter maintains cool, even temperatures within the cab, and an activated carbon "air recovery" installation bars fumes. Equipment is product of W. B. Connor Engineering Corp., 114 E. 32nd St., New York, N. Y.



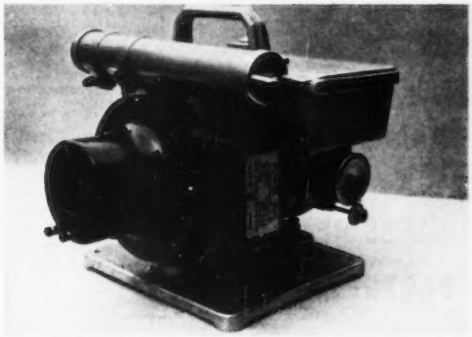
SELF-ROTATING electric hammer rotates and hammers drill bit at the same time. Drills up to 2-in. holes in concrete, rock or masonry. Is available for either 110 or 220 v.a.c. operation. Made by Syntron Co., 510 Lexington Ave., Homer City, Pa.

Portable Heavy-Media Separation Plant

Southwestern Engineering Co., 4800 Santa Fe Avenue, Los Angeles 11, Calif., has announced recently the manufacture of factory-built Heavy-Media Separation plants. The units are being pre-fabricated in the company's factory in Los Angeles from a SWECO design that has introduced new HMS features and simplified field erection. The process employed in the new plants, which are being made in 100 T.P.H. and smaller sizes, is that licensed by the American Zinc, Lead and Smelting Co., for which American Cyanamid Co. is the exclusive technical and sales agency. Construction and equipment details are shown in the accompanying photograph. Controls and layout of the plant permits one man operation. Where desired, the operator can also maintain the unit. The manufacturer claims low cost operation, low initial capital investment, mobility, and low power requirements.

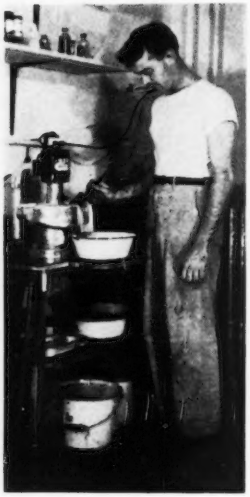


SOUND POWERED TELEPHONES need no battery or outside power for talking or ringing circuits. Common-talking, selective ringing systems up to 24 stations or unlimited common-ringing stations can be used. Made by U. S. Instrument Corp., Summit, N. J.



PORTABLE GENERATOR unit consists of a 400-w., 110-v. generator powered by a 1-hp. air-cooled gasoline engine. Weighs only 28 lbs. The manufacturer, Gico, Inc., 1820 Nash St., Arlington, Va., claims operating cost is 6c. per kw. hr.

BOOTH FLOTATION MACHINE



STAINLESS STEEL LABORATORY 1000 GRAM CELL ILLUSTRATED. CARRIED IN STOCK FOR IMMEDIATE SHIPMENT.

COMMERCIAL MACHINES IN SIZES UP TO 75 CU. FT. PER CELL.

BOOTH FLOTATION MACHINES PROVIDE FOR:

MAXIMUM RESULTS AND LESS REAGENTS

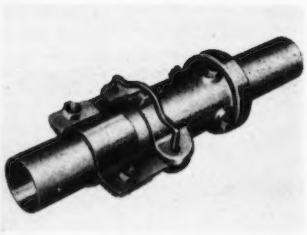
BOOTH ENGINEERS

ORE TESTING

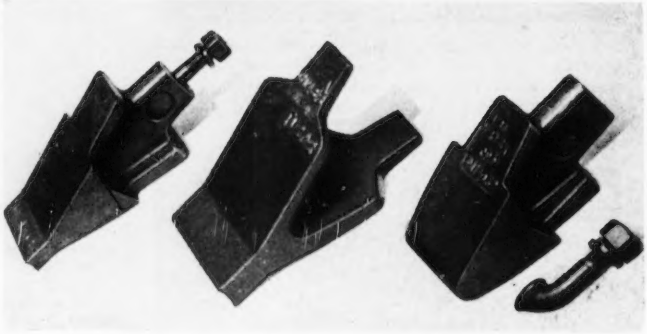
Process and Equipment Development

146 SO. W. TEMPLE

SALT LAKE CITY, UTAH



AIR COUPLERS on this aluminum air line (left) survived a rock slide in the Fall Creek area of Oregon. These easy-to-put-together couplings are made by Irrigation Equipment Co., Eugene, Ore.



SUBSTANTIAL SAVINGS in time and replacement costs are claimed by the manufacturer of this new tooth point for shovels and dragline buckets. Made of manganese steel, it is available with solid point or weld-on tip with separate base. Tooth point may be reversed from four to six times still maintaining a sharp cutting edge. Write Baker Point Co., 7238 Ridge Ave., Chicago 45, Ill., for further information.

BULLETINS

Electrical Maintenance. A 39-page handbook put out by Ideal Industries, Inc., Sycamore, Ill., entitled "Commutator and Slip Ring Maintenance" is a general handbook of procedures and methods.

Pumps. A well illustrated booklet on the company's opposed impeller pumps has been published by De Laval Steam Turbine Co., Trenton 2, N. J.

Electric Motors. Allis-Chalmers, Milwaukee 1, Wis., has published a booklet on their newest d.c. motors and motor controls.

Wire Rope. The Wire Rope Institute, Washington 5, D. C., has announced their bulletin No. 1 containing size data on wire rope sockets.

Wet Grinding. Hardinge Co., Inc., 240 Arch St., York, Pa., has just published a 16-page discussion of wet grinding mills, with complete coverage.

Synchronous Motors. Copies of Allis-Chalmers Synchronous Motors—Bracket Bearing Type, Bulletin 05B6112A are available by writing 969 S. 70th St., Milwaukee, Wis.

Radioactive Tracers. Extensive bibliography on the industrial uses of radioactive tracers is available from Arthur D. Little, Inc., Cambridge 42, Mass.

Pump Control. New booklet by Cutler-Hammer, Inc., 237 N. 12th St., Milwaukee 1, Wis., describes wide range of Cutler-Hammer control for domestic, commercial and industrial water systems.

Screen Cloth. Bulletin 113-A is available from Hewitt-Robins, Inc., 270 Passaic Ave., Passaic, N. J. Tables are included enabling the reader to determine at a glance sizes of openings available for any diameter of wire.

Telemetering Systems. A 20-page illustrated bulletin, GEA-5233, which describes the newest telemetering equipment for industrial applications has been released by General Electric Co., Schenectady 5, N. Y.

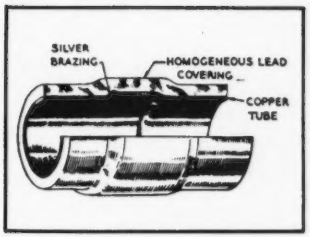
Piping. Bulletin 485 is a comprehensive treatment of stainless steel and nickel alloy anti-corrosion and anti-contamination piping. It contains extensive technical data, design tips and complete dimensional information. Write Taylor Forge & Pipe Works, Chicago 90, Ill.

Switching Locomotives. A new 16-page bulletin describing the 80-ton diesel electric locomotive for industrial switching has just been announced by General Electric Co., Schenectady 5, N. Y. Ask for bulletin GEA-3810A.

Dryers. Hardinge Co., Inc., 240 Arch St., York, Pa., has released a 32-page catalog on its complete line of "Ruggles-Coles" rotary dryers, kilns and coolers; bulletin 16-D.

Safety. Value of sight conservation program is described and illustrated in "Improved Industrial Vision, a Bonus for Management, a Benefit for Employees." Write American Optical Co., Southbridge, Mass.

Belting. A 28-page catalog giving detailed design, engineering and performance data for its line of transmission belting has just been published by United States Rubber Co., Rockefeller Center, New York 20, N. Y.



New Tubing Has Advantages

Lead covered copper tubing for heating and cooling coils offers several advantages that cannot be had with either lead pipe or copper tubing alone. Resistance to corrosion makes lead ideal for use in acids and chemicals. Its use, however, is handicapped by its strength which is unable to stand more than 40-psi. pressure, and its softness which is subject to erosion, particularly where steam is used. Its weight and the thick walls used which cut down heat transfer, are further disadvantages. Lead covered copper tubing, however, will withstand up to 150 psi. With the lead covering kept to a minimum, the thickness of copper-lead walls is still less than for lead pipe and the material is lighter. With the lead covering homogenously bonded to the copper, heat transfer between the two metals is greatly assisted. Bending technique is somewhat different from that of lead pipe but the principles are the same.

Write Andrews-Knapp Construction Co., 121 Broad St., New York.

INDUSTRIAL NOTES

Stanley E. Cobbledick has been appointed Sales Manager of the Franklin Steel Div. of **Borg-Warner Corp.**

Harry E. Lewis has been assigned to the Foreign and Export Dept., **Worthington Pump and Machinery Corp.**

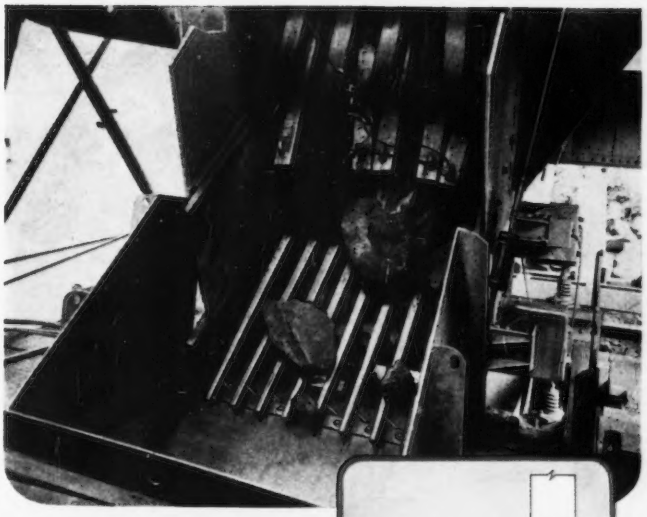
Great Lakes Carbon Corp. has named **John B. Hayes** sales representative for the Electrode Div.

Roebling Co. has a new office in Denver, Colo., at 4801 Jackson St.

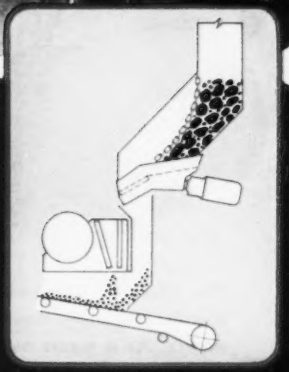
Denver Equipment Co. has appointed **Tench G. Swartz** field engineer for Arizona.

Brown Instrument Div. of **Minneapolis-Honeywell Regulator Co.** has assigned **John A. Robinson** as sales manager for Midwest, Rocky Mountain and Pacific Coast areas.

Westinghouse Electric Corp. has appointed **R. S. Kersh** and **F. D. Weatherholt** as managers of Central Station Sales and Industrial Sales, respectively.



JEFFREY-TRAYLOR
Electric Vibrating
GRIZZLY FEEDER



BY-PASSES FINES AHEAD OF CRUSHERS—PROTECTS BELT WITH CUSHION OF FINES . . . SAVES WEAR ON CRUSHER PARTS

Electric Vibrating Feeders are often equipped with a grizzly section at the discharge end for combining feed control with a rough, coarse sizing operation. They are used extensively to by-pass fines ahead of primary and secondary crushers and picking belts to scalp out large pieces ahead of screens—and to protect belt conveyors by bedding with fines thus providing a cushion for large jagged lumps. This type of unit provides a feeder and non-clogging grizzly in a single unit. It saves installation and operating expense as well as conserving headroom. Consult Jeffrey Engineers on equipment best suited to your Metal Mine needs.

Installation shown is a Jeffrey-Traylor electric vibrating grizzly feeder ahead of primary crusher equipped with tapered steel bars. Tonnage 600 T.P.H.— 4' x 0 cubes.

CONVEYORS • BUCKET ELEVATORS
FEEDERS • CAR PULLERS • CRUSHERS
CHAINS AND TRANSMISSION MACHINERY

JEFFREY ...ESTABLISHED 1877

THE JEFFREY MANUFACTURING COMPANY
974-99 North Fourth Street, Columbus 16, Ohio

SPEED · FOOTAGE AND HIGH DIAMOND SALVAGE

The HARDHED Bit contains selected, small diamonds, securely moulded in a tungsten alloy matrix. As it wears away, free-cutting edges are continuously exposed.

HARDHED Bits are recommended for drilling all types of ground, except extremely broken or abrasive formations. The HARDHED 55 Bit is recommended for drilling badly broken, highly abrasive formations. A special tungsten-carbide matrix enables it to stand up under the most exacting conditions where other bits fail.

Available in standard sizes and types. Special or off-standard bits to your order. Catalog on request.

J. K. SMIT & SONS, INC.

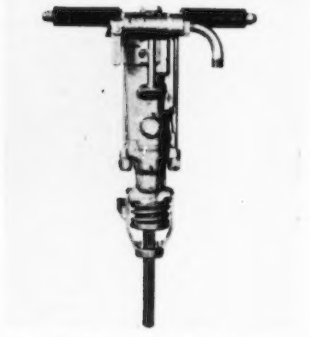
Gen'l Offices & Plant: MURRAY HILL, N. J.

In Canada: 129 Adelaide St. West, Toronto, Ont.

EST. 1888

SUPER MATERIAM IGNIS TRIUMPHANS

FIRBREGLASS CROWN is strong and resilient, impervious to moisture and acids. Resin-impregnated, it comes in any color. One type glows in the dark. Made by E. D. Bullard Co., 275 8th St., San Francisco, Calif.



NEW SINKER in the 45-lb. class is now made by Gardner-Denver Co., Quincy, Ill. The S 48 is designed for wet or dry drilling and is especially suitable for use with tungsten-carbide bits.

HYDRAULIC "GUILLOTINE" cuts wire rope up to 1¼ in., mild steel rod up to ¾ in. Adaptable for crimping, swedging and bending operations. Weighs 40 lbs. Made by Manco Mfg. Co., Bradley, Ill.

REGIONAL NEWS

URANIUM DEPOSITS are scattered throughout the world. Richest is probably in the Belgian Congo. Great Bear Lake, Canada, is the most substantial deposit in the Western Hemisphere. However, no exact production figures are known.

ALASKA

★According to J. C. Roem, associate mining engineer, in charge of the Department of Mines' assay office at Fairbanks, some activity, chiefly placer, was reported in the Fortymile and Bonniefield areas this summer. Some lode developments were also being planned.

★**Alaska Juneau Gold Mining Co.** reported combined sales and operating revenue of $29,948 for the quarter ending June 30, compared with $27,017 in the same period in 1948. Cleanup of concentrates accounted for $6,270 this year. For the half-year period ending June 30, the amount was $80,786 compared with $74,623 last year.

★A proposal by the Department of the Interior to issue an order withdrawing land from settlement, including the locations for approximately 70 hydroelectric power sites in the Territory, has been postponed, according to Delegate Bartlett. Assistant Secretary William E. Warren, was to visit the Territory in September. The withdrawal proposal may only be delayed until the Interior Department is granted legislative authority for developing the power.

★At the Snowbird gold-quartz mine, in the Willow Creek district, where exploratory work has been continuing for five years, capacity production was expected to be reached by Nov. 1, according to Chris Poulson, manager. A 40-ton ball and mill and a 400-kw. electric plant were being installed during the summer. About 30 men will continue work through the winter. The property is about 70 mi. from Anchorage.

★Mine Workers Local No. 444 of Fairbanks, which withdrew from the C.I.O. last year, has voted to affiliate with the International Brotherhood of Electrical Workers, A. F. of L., according to Frank Angerman, union organizer.

★**The Pewabik Mining Syndicate** of Juneau is exploring potentialities of placer copper mining at the head of the White River, according to E. F. Wann, president. If the operation goes forward, and results to date are declared more than satisfactory, it will be the first known placer copper operation in the world. Work of sinking shafts, cutting trails and establishing further camps will continue until December, with plans for next spring calling for shipment of equipment and beginning of operations as soon after the breakup as possible.

★The Independence Mine, the largest gold mine in the Anchorage area, will resume full-scale operations this fall for the first time since the war, according to an announcement by W. W. Stoll, president and general manager of the **Alaska Pacific Consolidated Gold Mining Co.** A crew that has been working at the mine this summer will be increased to about 75 men when mill operations start. Before the war, the mine produced more than $1,000,000 annually.

ARIZONA

★The state tax commission has ruled that uranium and gold mined in Arizona is subject to the state sales tax regardless of whether or not the ore is sold to the Federal Government. **Vanadium Company of America** had claimed its uranium output in Arizona was exempt from the tax because the ore was sold to the government. In holding that gold is not exempt, the commission reversed a long-standing practice.

★A $3,000,000 lead development program has been projected in the **Patagonia-Tubac area, Santa Cruz County,** in southern Arizona. **Salero Metals Corp.** has received State Corporation Commission approval to exceed $100,000 original capitalization by that amount. J. W. Crotty, Dallas, Tex., is president of the company. Sam Coupal, consulting mining engineer for the firm, has disclosed no plans as yet for the development on Baca Float No. 3 which is known to contain a dozen lead deposits.

★**Western Perlite Corp.** has bought out the processing facilities of the **Perlite Corp.** here, and will combine some equipment to increase production of concrete and plaster aggregate. E. E. Swift, president, said

Robins Gyrex Screen gives thrifty, dependable service on same installation since 1933

For more than 15 years the Robins Gyrex Screen pictured above has given low-cost service at the Mohawk Mining Co., Kittanning, Pa.

"It just runs on and on!" says D. H. Turner, Mohawk president.

Such long service is typical of what you can expect from Robins Gyrex Screens. You can use them for a wide variety of sizing or separating jobs—for coal, coke, gravel, stone, sand, rock, ore and many bulk materials.

Developed by Hewitt-Robins, the Gyrex vibrating screen is extremely versatile. It can separate as many as six different sizes at one time. It can size anything from fine hair to coarse rock. And it can handle hundreds of tons of bulk material every hour.

Once *you* install a Gyrex Screen, you will soon discover these five advantages:

1. Smooth operating. Has powerful vibration within itself. Yet *does not vibrate* the building or supports.

2. Versatile. Available in a weight to meet any class of service—a size to solve every problem. More than 300 models and styles.

3. Economical. Uses minimum of power per ton of material screened.

4. High capacity and efficiency. Uniform positive motion and correct centrifugal action.

5. Long life, low maintenance cost. All bearings super-sealed. All permanent connections electric-welded. All service connections jig-drilled for fitted bolts.

ROBINS

GYREX SCREENS

Consult Robins now. There's a Gyrex Screen to meet *your* exact needs.

SEND TODAY for Robins Bulletin No. 115-A. Fully illustrates and describes features, advantages and benefits of efficient Gyrex Screens. Address Robins Conveyors Division, 270 Passaic Avenue, Passaic, New Jersey.

ROBINS CONVEYORS DIVISION **HEWITT-ROBINS INCORPORATED**

Arizona *(Continued)*

several new furnaces have been purchased for processing ore from the company's mine at Superior.

ARKANSAS

★Approximately 1,000 CIO United Steelworkers of America have reported back to work at the Hurricane Creek plant and bauxite mines operated by **Reynolds Metals Co.** and **Reynolds Mining Corp.**

CALIFORNIA

★A 5-ft. layer of overburden is being stripped from gold deposits at the old Nugget mine on the east fork of Stewart's Fork of Trinity River, north of Minersville. Gravel being opened for dredging is said to have an average depth of 15 ft. Tests indicate a satisfactory gold content. C. Herbert, superintendent of the operation, is using a dragline dredge formerly operated in the area by **Thomson Divide Mining Co.**

★**Gold Hill Dredging Co.** has been granted a permit by the Siskiyou County Mining Zone Commission to dredge the Klamath River placer field near Scott Bar, with the provision that all agricultural acreage be resoiled.

The Gold Hill company also plans to resume development of the McCrea-Townsend group of 12 lead-silver claims in the Death Valley area, 4 mi. north of Townsend Pass. Cost of the project is estimated at $20,000.

★Installation of a pilot mill is nearing completion at the Sarita Mine in the Masonic district, 10 mi. east of Bridgeport. Gold production is scheduled to start soon by **Whinnery Mining Co.** The mill is capable of handling 100 tons of ore daily, and 85,000 tons of broken ore are reported available in surface workings. Ore will be taken out of open pits with power shovels. Page P. Blakemore, geologist and mining engineer, estimates the Sarita contains approximately 100,000 tons of ore averaging about $20 a ton in gold and silver.

★**ALA Mining Co.** of Los Angeles has found gold-bearing gravel in a new section of the old Mammoth Springs property about 25 mi. southeast of Grass Valley. A development tunnel has been extended 2,200 ft.

★Two high-producing mercury mines are operating near Guerneville, Sonoma County. At Mt. Jackson Mine, operated by **Sonoma Quicksilver Mines**, production is reported to be averaging about 350 flasks of mercury per month. The company, which employs 55 men, is said to be the largest American quicksilver producer.

Ajax Consolidated Mines Corp. recently resumed operations at its Contact mercury property. When it was operated a few years ago, the Contact produced cinnabar yielding 30 to 100 lbs. of quicksilver per ton.

Royal Drift Mining Co. is seeking the extension of old Magalia Channel by drilling virgin ground from the 500-ft. tunnel of its gravel property in Butte Creek Canyon, 8 mi. above Magalia. A gravity drainage system is planned to help in mining deep-seated paystreaks when the present exploratory program has been completed. Exploratory work last year disclosed some rich gravel, with material taken from the paystreak assaying up to $15 per cu. yd.

★Almon E. Smith and associates, controlling the **Magalia Mining Co.**, have acquired 1,600 acres of placer ground in the Magalia district, Butte County, from the Hagan interests, and are preparing to operate placer claims on both the Magalia and Mammoth channels, including the Genii property.

★**Central Eureka Mining Co.'s** mine at Sutter Creek in Amador County closed down for 10 days in September for reorganization of its labor force and physical setup.

The work force was cut by about one-fourth from a former 160, and returning miners agreed to a wage cut averaging 27½. Workers were given a group insurance program and a share of the profits. Details of the profit sharing plan have not been worked out, but the company plans to make it retroactive to Oct. 1 when they are completed. The new operating schedule is expected to save $18,000 to $20,000 a month.

The company will work the 3,600, 3,700 and 3,800-ft. levels, adding the 3,900-ft. level later. Only ore of .5 oz. and better per ton will be processed.

COLORADO

★**Park City Consolidated Mines Co.** of Utah has acquired the property of the **Keystone Mining Co.** and other acreage near Crested Butte, Colo. Richard C. Badger, vice president of the Utah corporation reports workings driven in the "nineties" have been rehabilitated and new ground is now being broken. The crew at the Keystone property consists almost entirely of Park City men, who were sent to Crested Butte when the Park City Consolidated was temporarily closed last spring.

Park City Consolidated also partially ceased operations at the company's lead property at Fredericktown, Mo., when the price of lead dropped from 21½ to 12c. a pound. The price of lead has since recovered and company officials are looking toward early reopening of the Missouri mill.

★**The American Smelting & Refining Co.** at Leadville, Colo., will smelt in the future all ore mined by the **Silver King Coalition Mines Co.** in the Park

For this Robins Screen or for any screen... always specify

ROBINS Screen Cloth

1 **Needs less changing.** Robins Super-Gyraloy Screen Cloth increases the time between screen cloth changes.

2 **Increases resistance to abrasion.** Super-Gyraloy Screen Cloth is made of specially blended alloy steel wire. Its heat treatment and micro-structure increase resistance to abrasion without sacrificing ductility.

In fact, a wire of this cloth can actually be bent around its own diameter without fracture.

Robins Super-Gyraloy Screen Cloth is tough, hard, stiff . . . yet elastic.

ROBINS SCREEN CLOTH

SEND TODAY for Bulletin No. 113. Fully describes Robins Super-Gyraloy Screen Cloth, 3/16" to 6" openings, made from #12 gauge wire to 5/8" rod in square and rectangular openings, flat top and non-blind weaves. Also in Gyraloy (spring steel), stainless steel, Monel metal or brass in any standard diameter of wire. Robins Conveyors Division, 270 Passaic Ave., Passaic, New Jersey.

HR

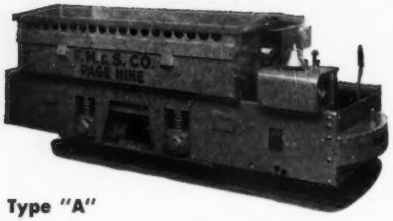
ATLAS LOCOMOTIVES

HAVE THAT EXTRA

QUALITY

FOR DAY AFTER DAY

OPERATION



Type "A"

The Atlas Type "A" is an economical, trouble-free locomotive for main line haulage.

Top production schedules can always be maintained with these rugged, heavy duty locomotives. Type "A" is equipped with the famous Atlas Double-Reduction Spur Gear Drive insuring ever efficient operation.

ATLAS ENGINEERING SERVICE IS ALWAYS AT YOUR SERVICE

Canadian Representatives
Mine Equipment Co.
Kirkland Lake, Ont.

International Agents &
Machinery Co., Ltd.
Vancouver, B. C.

South Africa
BMS Limited Industrial Stand
P.O. Box 50, Cleveland
Transvaal, South Africa

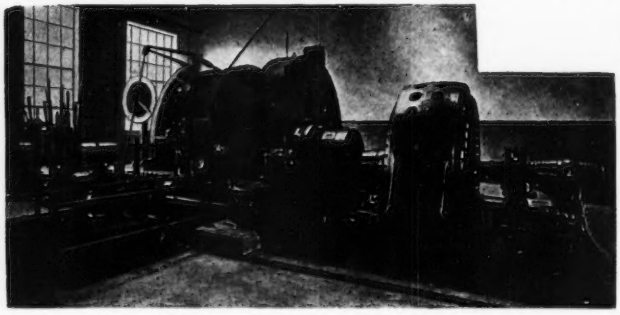
Complete Specifications on all types on request.

THE ATLAS CAR & MFG. CO.

ENGINEERS MANUFACTURERS

1140 IVANHOE RD. CLEVELAND 10, OHIO

Lepley **EQUIPMENT for METAL MINES**



We have no line of so-called "standard" hoists, but have been building steam and electric shaft and slope hoists for half of a century. Each design is based upon a first-hand study of all the factors, right on the ground.

Hoists

SKIPS
CAGERS
SHEAVES
ROTARY DUMPS
CONVEYORS
ROCK LARRIES
TIPPLES
COKE MACHINERY
AND ALLIED EQUIPMENT

CONNELLSVILLE MFG. & MINE SUPPLY COMPANY
CONNELLSVILLE PENNA.

Colorado *(Continued)*

City area. The mining firm announced its plans after AS&R said it would close its Murray, Utah, smelter Oct. 1.

★Continuing their study of the geology of the La Sal mountains, Dr. C. B. Hunt and Dr. G. M. Richmond of the United States Geological Survey, working out of the Denver office, have had a camp in La Sal Pass to complete their checking the south group of peaks, and they will then move camp to Geyser Pass or vicinity, for a study of the central group of peaks. At least one more year of field work will be necessary to complete the study of geology of the interesting La Sal mountains, Dr. Hunt stated. A book will then be published by USGS on the geology of the mountains, tying in with former publications covering other areas of southeastern Utah and western Colorado.

★Perlite experts from throughout the nation convened at Colorado Springs for the opening of the three-day business meeting of the Perlite Institute. Promotion of perlite and perlite products formed the keynote of the convention. Non-members of the Institute who are interested in perlite and the promotion of perlite products were invited to attend this meeting and take part in discussions.

★An appropriation of a quarter-million dollars and contract authority for another quarter-million dollars was voted by the Senate to continue work on the Leadville drainage tunnel in Colorado. An amendment providing the funds was placed in the Interior Department money bill. The house had provided nothing for the work. The difference will be settled in a conference committee.

★**The Champion Mines Co.** operating at Cripple Creek reports the Forest Queen shaft now down over 80 ft. into new ground below the bottom level at 955 ft. and making good headway with two shifts pushing the work. Announced plan of the company is to deepen the shaft 200 ft. into new territory and then develop horizontally by laterals in the contact area.

★Uranium mining operations on the Colorado plateau are expected to reach a new peak this fall. P. C. Leahy, manager of the Colorado raw materials office of the Atomic Energy Commission is said to estimate that approximately 300 mines will be operating. Between 1,000 and 1,200 men will be engaged in prospecting, mining and processing uranium. Six plants will be refining uranium and vanadium. The **Vanadium Corporation of America** owns or operates plants at Naturita, Durango and Hite, Utah. The **United States Vanadium Corp.**, operates plants at Uravan and Rifle.

George Gallagher, now in charge of the AEC raw materials office at Grand Junction, reports that tests of the remodeled mill at Monticello started recently with the Gallagher Co. of Salt

Lake as contract operator. Mr. Gallagher says that the almost-new mill operates along nearly the same principles as others but does feature a new dust collecting system. Improvement in processing may increase uranium recovery.

IDAHO

★**Sunshine Mining Co.** is cooperating with the Atomic Energy Commission and the Albany, Ore., branch of the U. S. Bureau of Mines in a search for radioactive minerals in the silver belt in the Coeur d'Alene mining district.

"Unofficial investigation was decided on several months ago," says Ross D. Leisk, general manager of Sunshine, "and has been carried out under the direction of Raymond F. Robinson, Sunshine geologist, and the Albany branch of the mines bureau. Pitchblende mineralization has been found on both the 3,100-ft. and 3,700-ft. levels in a zone north of the Sunshine vein near its western extremity.

"The mineral is microscopically fine," he said, "and its presence and the amount can be determined only through methods of radiometric chemical and X-ray analysis. Preliminary test work on concentration by conventional methods has not been successful. The grade of the material is now in relation to the narrow widths and we do not consider the discovery to be of present economic importance to the Sunshine Mining Co. It is probably of more importance as a possible domestic source of uranium in time of national emergency, when the high cost of production would be a secondary consideration.

"The Sunshine development is, of course, of considerable geological significance to the entire Coeur d'Alene district and will probably stimulate similar investigations at other mines in the area.

E. H. Thurlow, geologist for the Atomic Energy Commission, has since used the Geiger counter in the Silver Summit and Coeur d'Alene mines east of Sunshine, but results of this investigation have not been announced.

★The miners' strike in the Coeur d'Alene district, called by the IUMM & SW (CIO) union, has resulted in the closing of several important mines, the Bunker Hill smelter and curtailment of the output of the Sullivan zinc plant. The Bunker Hill mine is down, as are also the zinc-lead mines in the Pine Creek area in the western end of the district. The Dayrock mine of the **Day Mines Co.** in the Wallace area has been closed. **Federal Mining Co.**, whose concentrates are shipped to the **AS&R** smelter at East Helena, has been allowed to continue operations in the Kellogg, Wallace and Mullan sections, and some of the smaller mines and prospects are still operating under last year's labor agreements. The union is demanding a welfare and pension plan to be

"VIC" TELLS HOW

YOU GET THE MOST FOR YOUR MONEY WITH AN ALL-VICTAULIC SYSTEM!

Get *real economy* in your piping system. Save WORK! Save MONEY! with an ALL-VICTAULIC INSTALLATION.

A Complete Victaulic System is unbeatable for all-round flexibility and simplicity. It's the best way to solve tough piping problems and *keep piping costs* L-O-W!

Victaulic Couplings, Victaulic Full-Flow Elbows, Tees, and other Fittings are built for hard use . . . designed for quick assembling, give leak-tight dependability. Two-bolt coupling makes hook-ups quick and easy . . . a standard T-Wrench is the only tool required! Yes, VICTAULIC gives you the best in modern piping construction . . . assures long-lasting, leak-proof joints . . . safe, dependable service under toughest pressure, vacuum, or strain.

"*Vic-Groover*" makes pipe end preparation easy . . . grooves ends *automatically* in *half the time* of a conventional pipe threader!

CHECK INTO THE VICTAULIC LINE
Write for:
*Victaulic Catalog and Engineering Manual No. 44.
*"Vic-Groover" Catalog No. VG-47.

FOR FULL ECONOMY...MAKE YOUR PIPING SYSTEM ALL VICTAULIC!

SELF ALIGNING PIPE COUPLINGS
VICTAULIC
EFFICIENT FULL FLOW FITTINGS

VICTAULIC COMPANY OF AMERICA
30 ROCKEFELLER PLAZA, N. Y. 20, N. Y.
Victaulic Inc., 727 W. 7th St., Los Angeles 14, Cal.
Victaulic Co. of Can. Ltd. 200 Bay St., Toronto 1

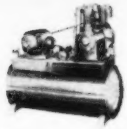
For Export outside U. S. and Canada: PIPECO Couplings and Fittings · Pipe Couplings, Inc., 30 Rockefeller Plaza, New York 20, N. Y.

Copyright 1949, by Victaulic Co. of America

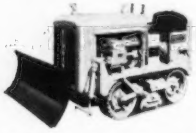
CHOOSE THE COMBINATION SUITABLE FOR THE JOB!

There's a Schramm Size for every Requirement

MODELS NUMBER 20 AND 35 COMPRESSORS . . . complete self contained engine driven units with capacities of twenty and thirty-five feet of actual air, available in a variety of mountings and assemblies.



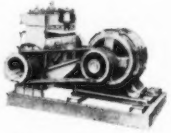
SMALL INDUSTRIAL COMPRESSORS . . . from ¾ to 5 H.P. single or two stage with horizontal or vertical tanks, working pressures, single stage up to 150 pounds and two stage up to 200 pounds pressure.



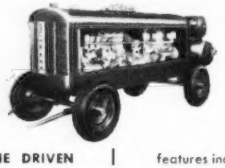
SELF-PROPELLED CRAWLER TYPE COMPRESSOR WITH HYDRAULIC BACKFILL BLADE . . . a versatile unit that not only excels in furnishing air for pneumatic tools but can also be equipped with many other attachments.

MODEL 50 "BUILT-IN" MOTOR DRIVE . . . the overhead tank unit is only one of the many models and combinations of this small compact industrial compressor that can be bolted direct to any substantial floor.

TRAILER WITH STREAMLINED TOOL BOXES AND LIVE HOSE REELS . . . designed for quick handling, this trailer type is equipped with towing ring or universal coupling for attaching to car or truck.



"V" BELT DRIVE ON BASE WITH MOTOR . . . this type assembly has proved very popular because it permits the use of the most advantageous operating speeds where only odd frequencies and voltages are available.



MODEL #315 DIESEL ENGINE DRIVEN COMPRESSOR . . . a powerful and economical unit built for heavy duty work . . . will operate three hard-hitting rotating rock drills, or one big wagon drill. Some of the features include: electric push button starting, automatic start and stop control, centrally located control panel, SCHRAMM patented mechanical intake valves, and many other features.

WRITE FOR BULLETIN SE-48

SCHRAMM INC.

THE COMPRESSOR PEOPLE • WEST CHESTER • PA.

Idaho *(Continued)*

financed entirely by the mining companies. Because of the strike the American Mining Congress, in session in Spokane, cancelled field trips to the Coeur d'Alene district.

★**Polaris-Silver Summit Mining Co.** has completed offset shaft operations to the 3,600-ft. level from the 3,000, and has completed a crosscut to the vein on the 3,200-ft. level, opening an 8-ft. width of high-grade silver-copper ore which was followed for 140 ft. as a preliminary test. Crosscutting was started on the 3,400-ft. level. Another crosscut will be driven from the 3,600-ft level. Not much official information is available, but concentrates are said to average from 750 to 1,000 oz. silver and 18% copper.

★Heavy black sand, which proved to be a nuisance to early Idaho placer miners, is now said to be one of Idaho's most valuable mineral assets because it contains varying amounts of radioactive minerals, including uranium and thorium. **Rare Earths, Inc.** has erected a plant at McCall, Idaho, and is producing the sand on a commercial scale, separating it into five different products, including monazite sand, ilmenite, zircon, magnetite and garnet. The monazite is shipped east for further processing.

The University of Idaho chemical engineering department has discovered 15 rare earth metals in monazite sand and is conducting further experiments.

The University has a license from the Atomic Energy Commission to secure sufficient monazite sand from the McCall company to carry on the experiments.

W. W. Staley, professor of mining at the Idaho School of Mines, estimates that 200,000,000 cu. yd. of placer gravel has been handled by Idaho placer miners and dredges. This sand will average from 20 to 100 lb. to the yard. Idaho gold dredges have recently installed special jigs to handle the black sand which is stockpiled for further processing.

★**Bunker Hill & Sullivan Mining Co.**, at Kellogg, has recently completed its main operating incline shaft to a depth of 3,700 ft. It is now believed to be the deepest lead mine in the world at a depth of 1,200 ft. below sea level.

From the present new deep level crosscuts will be driven to the Emory and Truman veins. The Truman vein is one of the outstanding major-sized lead deposits to be found in the United States in recent years. It has been extensively developed on and between numerous deep mine levels and averages 600 ft. in length, 12 to 15 ft. in width and, according to J. B. Haffner, general manager, returns average assay values of 8% lead and 5 oz. of silver per ton.

The present labor strike is the first serious labor trouble Bunker Hill has had since April 9, 1899, when the com-

pany's milling plant was dynamited by members of the AFofL union.

★**Silver Dollar Mining Co.'s** 1,800-ft. level crosscut into the Purim group had been temporarily discontinued because of the strike which closed productive operations from Silver Dollar's interest in the Rotbart area operated by Sunshine. Silver Dollar recently entered into an agreement with the **Polaris Mining Co.** whereby Polaris will develop the east end of Silver Dollar holdings on a 50-50 production basis. Polaris is now driving a drift from the 3,000-ft level to connect with the Silver Dollar 1,800-ft shaft. The company will then prospect the Chester vein in Silver Dollar and Silver Chieftain ground.

★The Grandview mine in the Metaline district, operated under lease by the **American Lead, Zinc & Smelting Co.**, of St. Louis, is now producing 800 tons daily, according to D. I. Hayes, Western manager. A 14-month labor strike has just ended. The company refused to resume operations until union leaders complied with the Taft-Hartley law and signed non-Communist affidavits. Under a new contract Grandview miners will receive a 4-c. per hour pay raise. While Grandview was idle the company deepened its main shaft 700 ft. and installed modern labor-saving machinery.

★**Clayton Mining Co.** has completed a crosscut to the vein at a depth of 100 ft. below the 300-ft level. According to officials, ore values are practically double what they were on the 300 averaging 7% lead as against 3%. The new level was a prospect venture to determine if the orebody continued its downward course. In the upper levels the commercial ore was spread over a width of 40 ft. or more, and had a maximum length of 360 ft.

★Crosscutting to the vein on its new 1,600-ft. level, the **Lucky Friday Silver-Lead Mining Co.** developed three veins instead of one, as was expected. The first vein was encountered 92 ft. south of the shaft and proved to be 12 ft. wide, averaging 8 oz. silver per ton and 2% lead. About 140 ft. south, the second vein was encountered that proved to be 7 ft. wide, averaging 11 oz. silver, 2.7% lead, 0.2% copper, and 0.95% zinc. Still further south and third vein was encountered and proved to be 6 ft. wide, assaying an average of 42.4 oz. silver, 8% lead, 1.16% copper and 1.3% zinc. A junction of the first two veins is expected at about the 1,800-ft. level. The **Hunter Creek Mining Co.**, which is prospecting a parallel group north of the Friday, has taken a contract to sink the Lucky Friday shaft to the 2,000-ft level.

★**Sullivan Mining Co.**, subsidiary of **Bunker Hill and Hecla**, has located 34 new mining claims in the Metaline district near Newport, Wash., in the "Z" canyon area.

★**Coeur d'Alene Mines Corp.** is driving a development drift westerly on

ABOVE: Cutaway view of typical EDISON cell used in mine haulage batteries.

Why EDISON *Batteries* LAST LONGER

CASE HISTORIES show that EDISON Batteries in mine-haulage equipment have fallen down shafts and gone through many wrecks with little or no damage . . . *and still delivered their full service life!* What is it that enables the EDISON Battery to withstand the most rigorous haulage duty and yet stay on the job year after year?

One of the many answers is its rugged, precise cell construction. Cell containers, covers, pole pieces and other structural parts are made of STEEL. Even the active materials are permanently locked in perforated STEEL tubes and pockets. These in turn are securely assembled into STEEL grids. Every STEEL cover is welded to its STEEL container, proof that no internal trouble is anticipated for the normal life of the cell.

EDISON Batteries last and last, and so through the years cost less and less. If you do not already use them, get price quotations from us. You may find prices lower than you think; cost per year less than you pay now.

ADVANTAGES OF EDISON NICKEL-IRON-ALKALINE BATTERIES: They're mechanically durable; electrically foolproof; quickly and easily charged; simple to maintain; not injured by standing idle.

EDISON

Nickel • Iron • Alkaline

STORAGE BATTERIES

EDISON STORAGE BATTERY DIVISION

of Thomas A. Edison, Incorporated, West Orange, N. J.

In Canada: International Equipment Co., Ltd., Montreal and Toronto

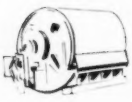
Nylon Filter Cloth

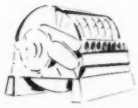
- Averaging 5 and more times longer life than cotton filter cloth
- Cleaner and Freer Cake Discharge
- More Cake Tons per Cloth Dollar
- Greatly Decreased Maintenance Labor through less frequent filter cover replacement
- No Attack by Molds, Fungi, or Alkali

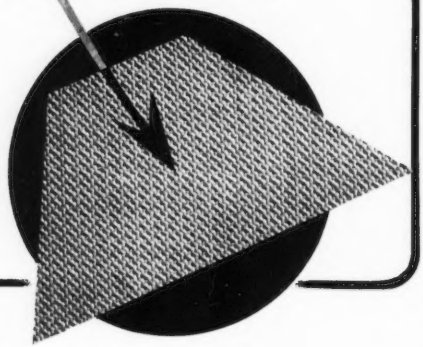
These advantages gained by using NFM Nylon Filter Media add up to increased filter output and reduced operating costs.

Specify NFM Nylon on your next filter cloth replacement order. You can obtain it either in roll form or as prepared filter element covers made to fit all standard filters at our two factories... New Haven and Salt Lake City. By letting us prepare your filter element covers, you will eliminate a usually costly and inconvenient item of filter maintenance.

Send for further data and laboratory test sample.







Weavers of Industrial Filter Media for over Forty Years

National Filter Media Co.

General Offices & Mills: New Haven 14, Conn.
Western Office & Factory: Salt Lake City 1, Utah

Sales Offices—Representatives

Chicago, Ill. 2627 West 19th St.
Cincinnati, Ohio Roselawn Center Bldg.
Houston, Texas 1406 Second National Bank Bldg.
Oslo, Norway Nicolai Friis
Johannesburg, South Africa Edward L. Bateman

Idaho *(Continued)*

its 1,800-ft. level to prospect the Commodore Truxon vein, which developed a promising showing of lead ore on the 1,000-ft. level. Stations are being cut every 300 ft. and diamond drills will be used to locate the vein.

★**The Vindicator Silver-Lead Mining Co.**, owning a property one mile east of the Lucky Friday, has completed a 1,400-ft. tunnel. It has cut through a wide shear zone of silver-lead ore at a depth of 400 ft., developing a streak of galena ore on the footwall of the zone for a length of 500 ft. The ore is similar in character to the Lucky Friday and is believed to be in the same mineral zone system. Deep shaft development is planned with the 500-ft. level as the first objective prospecting point. The property is equipped with substantial mine buildings, electric power and a modern air compressor plant.

★The United States Geological Survey has started the work of remapping four quadrangles in northern Idaho in the Pend Oreille and Clark Fork districts. The work, under the direction of E. L. Koltun, involves an area of about 800 sq. mi.

IRON COUNTRY

★**Cuyuna Ore Co. (Pickands, Mather & Co.)**, Ironton, has awarded a substantial rock-stripping contract to S. J. Groves & Sons Co. Work has already started and will continue into 1950.

★Aerial exploration for new iron ore formations, begun in 1947, was resumed about Sept. 1 by a U. S. Geological Survey party headed by John Henderson, geophysicist. The party worked out of Duluth through September and planned to cover an area of 1,800 sq. mi. in St. Louis County. After completing this, it will move to International Falls and then to Bemidji to cover an additional 8,000 sq. mi.

★About 40 members of the Minnesota Mineral Club made a two-day field study trip in the Hibbing area Sept. 10 and 11. Edwin Lambert, of University of Minnesota, was in charge.

★**Hanna Coal & Ore Co.** has moved its 7-cu. yd. dragline from the North Hillcrest property on the Cuyuna range to the West Feigh.

★At the South Agnew mine, the 25-cu. yd. dragline is nearing the end of its big stripping job. It is completing the last long cut in the pit, after which there will be left only a short, corner cut. The belt is being cut off as the drag works back. Two standard shovels are working on ore and clean up on a three-shift, seven-day-week basis, while the washing plant operated 20 shifts a week. During August 542,025 cu. yd. of stripping was moved.

★**M. A. Hanna's** Richmond mine, at Palmer, has received a Joseph A. Holmes Safety Association certificate of honor for operating 1,336,900 man-hours in an open-pit mine while producing 3,518,507 tons of ore, without a fatality since operations were begun in 1926.

★Although rejecting **Calumet & Hecla's** 20-c. reduction in the hourly wage rate, many of the 1,500 union men are working under "union protests"—perhaps a technical protection in case of future wage adjustments. Negotiations on a new contract are still being continued.

★The CIO strike vote at Lake Superior iron mines was not entirely one-sided. Employees at **Inland Steel's** Sherwood mine voted against a strike 50 to 20, with 19 undecided. The men at **Cleveland-Cliffs Iron Co.'s** Mather "A" and "B" mines at Negaunee are also said to have voted against a strike though other mines of the company voted for the walkout. A letter which R. D. Satterley, general superintendent, issued to each employee probably influenced the Sherwood mine vote. It read: "You will shortly be asked to vote on this important question: Do you want to go on strike? Before you vote on this you will want to be sure you know what the issues are. You will want to be sure that your representatives in the union have bargained fully and fairly with the company's representatives and that there is no further hope of settlement of the issues through bargaining.

"Is this true in this case? We do not believe so. The union has not been willing to discuss with us the special circumstances that apply to Inland. The union asks for pensions. Inland has a fine pension system. The union asks for life and hospital insurance. You know that these coverages are also available to Inland men. The union asks for a wage increase. You know that the demand for iron ore is declining. Increased wages—and, therefore, increased costs—will bring about further declines.

"Bargaining has not been exhausted. It has not even been attempted. The union's goal is to swallow Inland up in a national pattern. It has no regard for the benefits Inland men already have. A vote to strike is a vote to abandon bargaining with Inland. It is a vote for industry patterns; for labor monopoly. Be sure that you vote. But be sure also that you know what you are voting for."

★Miss Sarah J. Barras of Grand Rapids, Mich., has recently negotiated to lease mining rights in the Stambaugh area to **Hanna Iron Ore Co.** This is the fifth lease Miss Barras has concluded in the area; all to the Hanna Iron Ore Co. or the **Cleveland-Cliffs Iron Co.** She is the owner of several hundred acres near Stambaugh and Mineral Hills.

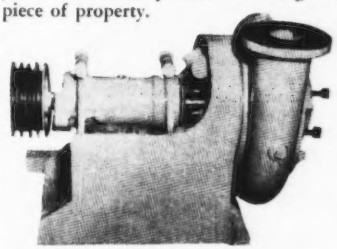
★Among new laws in Michigan which

YUBA Dredges and Parts

Will help you attain

HIGH RUNNING TIME • HIGH YARDAGE
HIGH RECOVERY • LOW OPERATING COST

There's a large measure of truth in "practice makes perfect" as YUBA has amply demonstrated in 40 years' experience in designing and building placer mining dredges. From the tin mines of Malaya to the gold mines of Alaska—the length and breadth of the globe, you will find YUBA dredges in successful operation in every sort of dredgeable material. Each dredge was designed and built with just one objective: Efficient operation on the given piece of property.



Model "S" 3" Yuba sand pump used for sand pumping on jig equipped placer dredge.

It will pay you, too, to consult YUBA *for all such items as these:*

- Bucket Ladder Dredges
- Hull Pontoons, portable type
- Steel Hulls and Superstructure
- USS Abrasion Resisting Steel Plate
- Screen Plates, ARS wear resisting
- Screen Rings and Bolts, Piping
- Revolving Screens and Parts
- Lower Tumblers and Bearings
- Upper Tumblers and Wearing Plates
- Buckets and Lips, manganese steel
- Bucket Pins, heat treated and alloy steels
- Lip Bolts—Pin Wedge Bolts
- Control Units—Depth Recorders
- Power Units—Electrical Parts
- Winches, ladder hoist or swing
- Pumps, high and low pressure
- Ladder Rollers and Bearings
- Stackers and Stacker Belts
- Bolts for Wearing Plates
- Wire Rope and Fittings
- Riffles—Jigs—Tables
- Perry Bucket Idlers

SPECIAL EQUIPMENT BUILT TO ORDER

Complete steel fabricating, forging, and machine shops at your service. Send us your blue prints or specifications for prices.

Wire, write, or phone YUBA for help on all dredge problems. No obligation.

NORTHERN OPERATORS, ORDER NOW FOR EARLY SPRING DELIVERY!

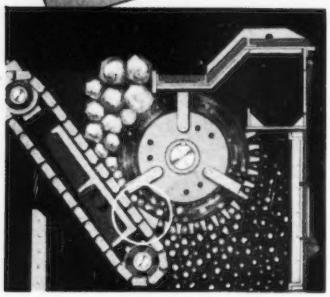
YUBA MANUFACTURING CO.

Room , 351 California St., San Francisco 4, California, U. S. A.

AGENTS { SIME, DARBY & CO., LTD. · SINGAPORE, KUALA LUMPUR, PENANG.
SHAW DARBY & CO., LTD., 14 & 19 LEADENHALL ST., LONDON, E. C. 3.

CABLES: YUBAMAN, SAN FRANCISCO · SHAWDARBCO, LONDON

THE ONE and ONLY NON-CLOG The tried and proven DIXIE HAMMERMILL



Extended Moving Breaker Plate construction (illustrated) guards against passage of oversize material . . . results in improved grinding control.

Your Assurance of Greater Production At Less Cost

The one and only Dixie NON-CLOG Moving Breaker Plate Hammermill* sets a new standard of crushing efficiency in the reduction of wet, sticky materials.

If you have wet, sticky material to crush, if you have any crushing problem at all, it will pay you to take advantage of this vastly improved crushing principle.

Dixie Non-Clog Hammermills are made in sizes ranging from 24" up to 72" diam.

WRITE TODAY FOR COMPLETE INFORMATION

*U. S. Patents Granted & Pending.

DIXIE MACHINERY MFG. CO.

Main Office and Plant
4204 GOODFELLOW AVE.
ST. LOUIS 20, MO.

TAILINGS DEPOSITED from the flume in the background are dozed into the settling basin by a Tournadozer at the Rosebar Developing Co. gold mine, Oroville, Cal.

Iron Country *(Continued)*

became effective in September, was an amendment to the Workmen's Compensation Act which increases benefits payable to injured workers and to dependents of those fatally injured. The length of time employees are entitled to medical care was also increased under the amendment.

★Among the mining communities looking for a new water supply are Hurley, Wis., (Gogebic range) preparing to start its thirteenth hole after twelve failures; and Stambaugh township, Mich. (Menominee range) which is ready to begin drilling a new hole for water.

★Lake Superior iron ore shipments for August showed a small drop from August, 1948. The figures were: 11,-314,928 tons as compared to 11,734,-794 tons, a drop of 3.58%. Total tonnage as of Sept. 1, however, at 57,-268,216 tons is 2,698,507 tons ahead of 1948.

★Henry A. Burkhammer, Duluth district CIO director, announced that Minnesota members of the United Steel Workers union voted 9 to 1 in favor of a strike. He stated that 11,-056 members out of 14,000 eligible voted with 9,769 in favor of a strike and 1,287 against.

KENTUCKY-ILLINOIS

★The newly organized **Golconda Mining Co.**, which purchased the old Baker fluorspar mine, in the Humm's "Wye" section of Hardin County, Ill., has reopened the property and is now mining a 6-ft. vein of fluorspar. L. S. Barger and Jack Quarant, both of Golconda, Ill., are president and secretary-treasurer, respectively. The tract covers 320 acres and was purchased from the First National Bank of Golconda. The Baker lies immediately north of the Stewart and the Jefferson mines.

★**Delhi Fluorspar Corp.** of Marion, Ky., has completed installation of conveyor barge-loading equipment on the Kentucky side of the Ohio River, opposite Cave-in-Rock, Ill. The conveyor is 62 ft. long. Three barges of ore, hauled from Delhi's Crittendon County mine, have been recently shipped. Formerly Delhi shipped via Cumberland River barge from Dycusburg, Ky.

★**Alco Lead Co.** has installed a 250-gal. pump and an 8,000-ft. pipe line to bring water from the Ohio River into a storage pond at the Old Patrick, open-pit lead mine in the Cave-in-Rock section of Hardin county. The mill's water supply was seriously diminished during the summer months. Increased efficiency in mill operation has resulted from recent installation of a new jaw crusher by Alco Lead Co. at the Old Patrick lead mine. It replaces the bar trommel formerly used.

★**Ozark-Mahoning Co.** has started sinking a new shaft on the Ida Oxford tract in the Cave-in-Rock fluorspar district. It will be 365 ft. deep.

MICHIGAN

★A direct appeal by E. R. Lovell, president of **Calumet & Hecla Consolidated Copper Co.** to John L. Lewis, president of the **United Mine Workers**, to take immediate action that would enable Calumet & Hecla to obtain a supply of coal sufficient to operate its mines throughout the winter, proved futile.

The Lewis office replied, through W. A. Boyle, assistant to Lewis, that "We appreciate the requirements of your company and assure you that we are doing everything possible to relieve such problems." Mr. Boyle then added the following:

"We would advise, however, that the existing difficulty has been brought about by the selfishness of representatives of industry who utterly disregard the human element involved. In this respect, I suggest you write your requests to those responsible parties in an effort to convince them

that a reversal of their persistent begrudging attitudes toward the men of the mines, their families and pensioners will be instrumental in satisfactorily bringing an end to the present situation."

Mr. Lovell's telegram to Lewis, also sent to President Truman and Governor Williams of Michigan, stated that the immediate abandonment of copper mining in Michigan was threatened unless fuel can be obtained before the close of lake navigation. It called attention to the fact that the life-blood of a community of 30,000 people is dependent on the copper mining industry.

"I appeal to you in the name of the people of this community and to your sense of fair play to call upon men to voluntarily supply the coal which is our lifeblood—without awaiting conclusion of your contract negotiations," Lovell wired Lewis.

Since the Lewis office replied, indicating that the appeal would not be heeded, Calumet & Hecla received reasonable assurance that the company's coal needs will be supplied. Through the assistance of the Michigan Fuel Administration, 20,000 tons was located in Duluth which will be available for shipment to Calumet & Hecla later this month. Subsequently, another 10,000 tons was found to be available at Duluth and this tonnage was to be shipped at once. Then came word that the regular coal suppliers of Calumet & Hecla would obtain the remainder of the 100,000 tons required to insure operations through the winter. So, it was officially stated, the danger of a suspension of operations practically has been removed.

MONTANA

★**Interstate Products Co.**, C. W. Lester, president, Billings, expects to start mining and processing asbestos from the Pete Karst properties in Gallatin Canyon, Gallatin County, south of Bozeman.

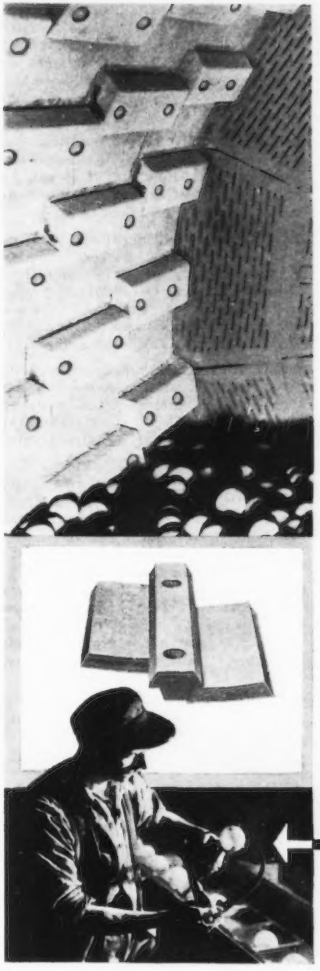
★Montana Section, National Safety Council, expects to hold a meeting in Helena in November, according to Walter H. Myers, president of the **U. S. Grant Mining Co.**, Virginia City, and president of the Montana Section.

★**Silverton Mining Co.**, an Idaho corporation, has nearly completed unwatering the old workings of the Cumberland mine, near White Sulphur Springs, Meagher County, which was a large lead and silver producer in the early 90's. At that time high-grade lead carbonate ore, with substantial amounts of silver, was mined and treated at a local carbonate smelter. Present operations are to recover lead sulphide ore which could not be processed in the old smelter. Steve Guilio, Helena mining engineer, is in charge of operations.

★A semi-confirmed report from Boulder, Jefferson County, indicates that radioactive mineral has been

LORAIN ROLLED PLATE LININGS

... for better grinding results
... for quicker, easier installation
... for more economical maintenance
... for longer life



ON all sorts of grinding jobs, Lorain Rolled Plate Linings are helping to increase production, save time, and cut costs. Because the parts are made to accurate size and in easily handled sections, they save hours of labor and reduce mill down-time. And because of the great strength of rolled carbon steel, a plate of reduced thickness can be used—thereby increasing the usable diameter of the mill and boosting output.

As lift bars wear down in service, Lorain Rolled Plate Liners may be restored to full grinding efficiency and the equivalent of a second lining by renewing the lift bars at only partial lining costs. Where pronounced variance in wear occurs at feed and discharge ends, the liner plates, being made symmetrical and interchangeable, may be reversed to opposite ends of mill to balance wear. Such flexibility and ease in restoring lining efficiency means reduced grinding costs.

U·S·S Lorain Rolled Plate Linings are available through leading mill manufacturers whose names will be furnished upon request.

Use U·S·S GRINDING BALLS to make better, more economical grinding doubly sure.

U·S·S Grinding Balls are especially made for the industry to the most exacting specifications of hardness and toughness. Standard sizes available from ¾" to 5".

CARNEGIE-ILLINOIS STEEL CORPORATION, PITTSBURGH & CHICAGO
COLUMBIA STEEL COMPANY, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM, SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK
9-1451

LORAIN ROLLED PLATE LININGS AND GRINDING BALLS

USS UNITED STATES STEEL

found over a large area in that vicinity. It is reported in Spokane that the Sunshine Mining Co., of Kellogg, Idaho, has engineers investigating the discovery.

NEVADA

★**Round Mountain Gold Dredging Co.** made test runs with a 1,700-ft. conveyor belt, one of several to be used for carrying gold gravel to the recovery plant. The company hopes to start producing this fall. At present, 80 to 90 men are employed on construction.

★The Newmont mill at Goldfield will handle gold ore from the Louisville-Hobo mine in Rhyolite, if it can be milled in quantities of 100 tons or more.

★High-grade ore, reported to assay as high as $60 per ton, has been located at the property of **El Dorado Gold Mines, Ltd.**, in the Awakening district, 48 miles northwest of Winnemucca. A 10-ton stamp mill is scheduled to start operation immediately.

★Fire at the Buckingham mine camp, near Battle Mountain, completely destroyed five buildings and a large bunk house. Loss is estimated at $35,000. Origin of the fire is unknown.

★Placer mining continues to expand on the Middle Fork of the Yuba River near Nevada City. Operators are producing raw gold which is in demand at better than $40 per oz.

Several men are engaged in sluicing gravel on Canyon Creek above Washington. Limited operations have been resumed at the Plumbago and Gaston placers in the North Bloomfield area. New Equipment has been installed at the Plumbago.

NEW MEXICO

★**Elayer & Co.** have started operations at the Lynchburg lead and zinc mine at Magdalena under lease from **Empire Zinc Co.** Before the price drop they had worked production up to 3,000 to 3,200 tons per month. They plan now to hold the grade to 12-13%, leaving 8% on the dump.

★There has been a renewal of interest in the northern New Mexico mica district, and rumors are current of a $250,000 mica mill at Santa Fe.

★Relinquishment of the Army's demands for a 33-mi. extension of its bombing range in south-central New Mexico has led to activities in the Hansenburg district, central New Mexico. Irwin & Bishop, of Houston, are building a mill at San Antonio to treat fluorspar and barite (CaF_2 and $BaSO_4$).

★Arthur Montgomery, lessee of the

If it is, your Hoisting Equipment is at top Safety Efficiency

THE LATCH LOCKS THE LOAD

Make *safety certain* by specifying Laughlin Safety Hooks when you place your next order for hoisting equipment.

Is Your Present Hoisting Equipment Safe? You can boost its safety factor by replacing ordinary hooks with Laughlin's exclusive Safety Hook . . . there's one for every hoisting or materials-handling job. Available in capacities from ½ ton to 15 tons.

Write for catalog #145. THE THOMAS LAUGHLIN COMPANY, DEPT. 5, PORTLAND 6, MAINE.

LAUGHLIN

THE MOST COMPLETE LINE OF DROP FORGED WIRE ROPE AND CHAIN FITTINGS

Replace WITH Barber-Greene BELT CARRIERS

Many hard-used belt conveyors are causing excessive belt wear, consuming unnecessary power and are otherwise a source of trouble due to worn-out belt carriers. Now is the time to check yours and, at small cost, replace with new Timken or ball bearing-equipped Barber-Greene Carriers. A full range of sizes and types immediately available, featuring all-welded construction, interchangeable rollers with internal grease reservoir in each roller. See your B-G distributor or write:

Barber-Greene Co.
Aurora, Illinois

117A

Harding Mine in Taos County, is preparing for a small beryl operation. During the war Mr. Montgomery mined microlite and tantalite there, and also some tonnages of lithium ores and beryl.

★Marshall Kuykendall has set up a perlite expanding furnace and block-making equipment at Lordsburg. There has been some active leasing of perlite deposits in the state.

★**Santa Fe Pumice Co.** has opened new mines on a tract in Ganje Canyon comprising 5,300 acres, 27 mi. from the railhead at Santa Fe. The deposits are said to contain 150,000,000 cu. yd. of mineable pumice. The company is operating its new plant at the mine site and shipping six grades of pumice to customers in 25 states. Plant capacity is 3,600 cu. yd. of finished products per 24-hour period. All storage bins have been constructed of pumice concrete. One form of storage being used is a concrete tube 300 ft. long that conveys pumice by gravity to a rail spur for loading. The tube will hold enough product to fill 15 cars.

OREGON

★The Esterly gold and platinum mine, in Josephine County, is being outfitted with a dragline and dry-land washing plant. It is now being operated by R. F. Oliphant and G. C. Pepperdine.

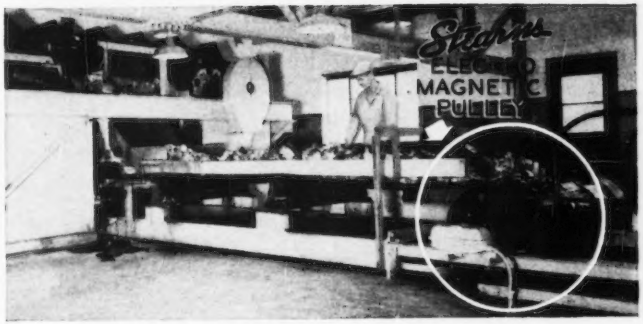
★It is reported that five pumice operators are working on the Bend area, one at Chemult, and one at Burns, and that two other operations are being considered.

★The Hamlen copper holding, southwest of Grants Pass, has had a rail tram built to carry ore from the main tunnel to the road for trucking. Exploration work has been done by J. E. Hamlen and Ben Baker. Shipments will go to the Tacoma smelter.

★A four-stamp mill has been installed at the **Gold Plate mine** near Galice, Josephine County, and operations have been started on the property. The mine is owned by W. W. Phillips and Charles Skeeters.

★An initial shipment of 97 tons of ore from the Bratcher tungsten mine near Ashland to the Tulare County tungsten mines plant at Lindsey, Cal., yielded 109 units of tungsten trioxide. Surface explorations are being continued at the mine site to determine the lateral extent of the ore.

★**Pacific Carbine & Alloys Co.**, Portland, has purchased the Black Marble limestone quarry near Enterprise, Ore., from the Reconstruction Finance Corporation. Included in the sale are three shaft-type lime kilns and other facilities. Immediate plans call for only sufficient quarry operations to supply limestone for the two Ellernan kilns that are a part of the company's Portland calcium plant.



Protect **YOUR MACHINERY**
with a STEARNS MAGNETIC PULLEY!

Metallic refuse can cause costly repairs and possible shut-downs but at the American Crystal Sugar plant in Moorhead, Minn., a Link-Belt installation, this Stearns Electro-Magnetic Pulley helps guard against trouble.

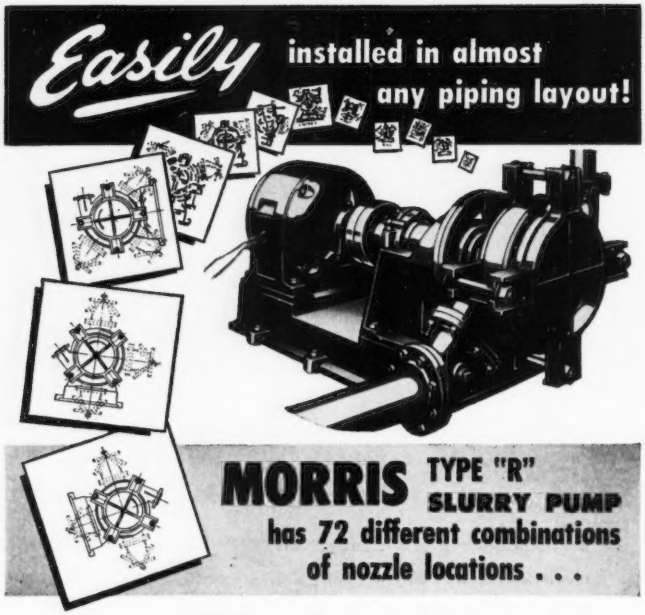
If you want automatic low-cost protection against tramp iron hazards, consult *Stearns Magnetic* — our engineers have the know-how and experience to solve your problem.

Years of research and development by Stearns engineers have produced an outstanding product in magnetic pulleys — the reason for their wide acceptance in all industries for removing tramp iron, for separation and reclamation of materials.

For complete specifications and operating data on Stearns Electro and Permanent Magnetic Pulleys and Pulley Separators, write for Bulletins 303 & 350.

Electro and Permanent Magnetic Pulleys and Pulley Separators to fit your needs.

Stearns MAGNETIC MANUFACTURING CO.
624 S. 28th ST. MILWAUKEE 4, WIS.


Easily installed in almost any piping layout!
MORRIS TYPE "R" SLURRY PUMP
has 72 different combinations of nozzle locations . . .

● The suction disc swivels on the hooded bearing frame fit. This means that you can put the suction nozzle in almost any position, including the vertically upward position. This location is particularly convenient if you intend to put the pump directly under a suction tank or chest.

● The shell of the Morris Type "R" Slurry Pump is also simply constructed with extra heavy wall thickness. Its symmetrical shape permits either right or left hand rotation. By swiveling on the suction disc, you can get eight different positions of the suction nozzle.

Other features of the Morris Type "R" Slurry Pump

EASY DISMANTLING

You can renew the impeller and shaft sleeve without disturbing the suction and discharge piping or bearings.

LONGER TROUBLE-FREE OPERATION

The Morris Type "R" does not have internal studs or bolts. The liner is firmly clamped in position, shoulder-fit between disc and shell.

ALL-TIME LOW IN STUFFING BOX MAINTENANCE

The Morris Type "R" takes its suction from the drive side only. Equally reliable under high suction pressure . . . high vacuum and high suction lift.

FOR MINING OPERATIONS

The Morris Type "R" Slurry Pump handles all types of mixtures containing abrasive solids and chemicals in suspension, including acid slurries and sludges . . . and slurries containing soda ash, ore concentrates, tailings, slag, coal, etc.

MORRIS MACHINE WORKS
Baldwinsville, N. Y.
Branch Offices in Principal Cities

MORRIS *Centrifugal Pumps*

UTAH

★Utah mining men are deeply interested in the **Bullion Monarch Mining Co.'s** recently discovered uranium ore deposits in the Marysvale district of the state. With the exception of a single small showing in jasper west of the Sevier River in the Tushar Range, the ore thus far discovered is in a sector where no mining of any type had ever been undertaken previous to the find. The discovery region is in a porphyry formation between outcrops of rhyolite five miles northeast of Marysvale in Piute County, on the east side of the Sevier.

The deposits have been located in rolling hill country in which the tallest peaks reach an altitude of about 7,000 ft. According to engineers at the scene, the ore deposits indicate a definite east-west strike of two veins and apparently widely disseminated deposits in andesite porphyry, bounded on the north and south limits by rhyolite. Mining men feel the generally accepted theory that secondary uranium ores do not occur over large areas and disseminated through the formations is contradicted in the Marysvale discovery.

The strike has been drilled to a depth of 135 ft. along a 30-deg. open slope for 800 ft. It is at least 200 ft. in width. The uranium is found in a sulphur-colored autonite, some two miles distant from previous wartime kalunite diggings. The Marysvale autonite is said to fluoresce brightly, and discovery samples have shown uranium contents of 0.36 to 0.76%.

Ore has already been developed south of the central open cut fairly close to the surface. Three shallow prospect shafts reportedly disclose a vein of fairly high-grade ore 10 to 12 ft. wide in a line showing a definite east-west strike. Thirty tons of ore were shipped by mid-September from one shaft. A 6-ft. round in one of these shafts discloses continued presence of ore which may mean widening of this vein.

The discovery is currently leading to discussion as to whether or not straight open-cut mining may be possible at Marysvale, due to the wide dissemination of the ore.

The Atomic Energy Commission is, according to Salt Lake City reports, greatly interested in the Marysvale situation, and **U. S. Vanadium Corp.** is likewise reported to have evinced interest. However, no rates have been reported established for the ore, this being the first autonite discovery reported. It is noted that autonite, a calcium-uranium-phosphate, contains 60% uranium oxide in its pure state. Assays at Marysvale deposits show .3% to .7% uranium oxide.

★Operations have been resumed at the **New Park Mining Co.** at Park City, Utah, one of the major producers in the field, which shut down July 1. Initial shipments began in late September, but W. H. H. Cran-

mer, president of the company, reported full production could not be expected before Jan. 1, 1950, because of the need for careful inspection work. The present plan is to concentrate on gold-bearing Pearl fissures in the property, due to the higher value of its ore. Cranmer states development on the Pearl fissure will extend to the 1,500-ft. level.

Prices for lead-zinc ores still make development of some other areas of the mine unprofitable. Meantime, despite a series of meetings between mine union officials and executives of other properties in the Park City field, none have reopened. Present metal prices and material costs, plus labor costs, may make reopening economically unfeasible for some time to come. At New Park, workers returned at the same wage scales that were in effect when the shutdown occurred. According to some observers, it may be necessary for mine union members to accept some form of production-incentive pay plan before other mines can reopen at a profit.

WASHINGTON

★**Pend Oreille Mines & Metals Co.**'s Canadian subsidiary, the Reeves MacDonald, was credited by **Consolidated Mining & Smelting Co.** as having reached first place in its shipments of zinc to the Trail smelter for the week ending Sept. 17. The Reeves sent 139 tons of concentrates from Salmo to the smelter.

★**Meadow Creek Mining Co.**, with property near Kellar, has to advance about 40 ft. from its recently driven 750-ft. Pearl tunnel to get below the best showings 700 ft. above. The company holds 15 claims in the area which was withdrawn from mineral entry in 1934. It is included in the area which the Interior Department is trying to restore to the Colville Reservation.

★**Metaline Mining & Leasing Co.** planned to reopen its mine at Metaline Falls, Oct. 1, with about 30 former employees according to James L. Leonard, president. Operations were closed in January because of the Grandview mill being closed. A new contract has been accepted by the CIO Metaline Falls local 515 which provides a 2-c. hourly raise, and 32c. per shift. Wages of the Coeur d'Alenes are to be met by the agreement. Zinc-lead ore reserves have been increased at the mine in the meantime.

★The Grandview mine, under strike for 14 months, was getting back into production during September. Machinery and equipment were readied and ore was being blasted, according to Dale I. Hayes, Spokane, western manager for **American Zinc, Lead & Smelting Co.** A total force of 150 would eventually be hired.

★**R. R. Feak**, of Seattle, has opened a tungsten deposit on a property

"Standard of Quality" is a registered phrase designating certain Goodall products which, through their outstanding quality and reliability, have earned the tribute this designation implies. It is your guarantee of *lower service costs* under severest working conditions.

GOODALL "SSS" CONVEYOR BELTING

A "Standard of Quality" product, built for Super-Severe Service. Backed by many years of belt-building experience and a reputation for superior strength, durability and economy on long, heavy hauls. Custom made to meet specific requirements. Contact our nearest branch for quotation on "SSS" belting *engineered to your job.*

GOODALL RUBBER COMPANY

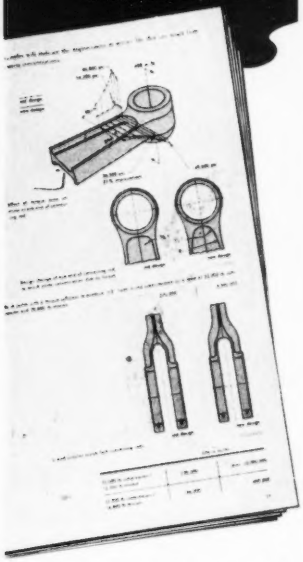
GENERAL OFFICES, MILLS and EXPORT DIVISION, TRENTON, N. J.

Branches: Philadelphia • New York • Boston • Pittsburgh • Chicago • St. Paul • Los Angeles
San Francisco • Seattle • Salt Lake City • Denver • Houston • Distributors in Other Principal Cities

Est. 1870

WHAT ABOUT STRESS RAISERS?

This book gives the answers..



How to avoid the localized stresses which start failure is a basic problem of design. This 72 page booklet analyzes many good and bad features of design. It also deals with problems of steel selection and treatment from the viewpoint of the design engineer —instead of the metallurgist.

Write for "3 Keys to Satisfaction"—it is free.

Climax Molybdenum Company

500 Fifth Avenue · New York City

Please send your FREE BOOKLET 3 KEYS TO SATISFACTION

Name.....

Position.....

Company.....

Address.....

EM-11 F21

Washington *(Continued)*

north of Springdale, and has discovered some chalcopyrite. A 40-ft. tunnel has been driven into the copper-silver vein with the last 20 ft. showing a full face of ore. Mr. Feak has been inspecting the old Germania mill with the possibility of leasing it to handle the tungsten ore.

★**Alder Gold-Copper Co.**, with property five miles southwest of Twisp, expected to start operating its new 250-ton flotation mill the first part of October. Capacity can easily be raised to 500 tons when necessary, according to Roy K. Magney, secretary. Harvey F. Stone is mine manager.

★**Homer A. King, of Big Dome Mining Co.**, reported that the deposits at the property near Salmon Lake, in northern Kittitas County, have a uranium content above the minimum set by the Government for development. Mr. King said that the metallurgical division of the U. S. Bureau of Mines office at Salt Lake City reported indications that the ores contain 2 lb. of U_3O_8 per ton, while the Government has indicated interest in deposits with ¼ lb. per ton.

★**Talisman Mining & Leasing Co.**, which operates the Laurier mine, near the Canadian border, is now operating under new management. William Hicks, of Spokane, who has been elected president, was the only member of the old board reelected. The mill was to start operating again on a 24-hr. basis in September, according to Mr. Hicks. A newly-opened deposit assayed $37.02 a ton in zinc, lead and silver. Sixty tons of zinc concentrates were to be shipped to Trail.

★**Mines Management, Inc.** has started hauling ore from its Advance mine south of Northport, in Stevens County, to the **Goldfield Consolidated Mining Co.'s** mill. A raise in the upper levels of the mine is furnishing about 50 tons of zinc-lead ore daily. From 10,000 to 15,000 tons are available but a test run will be made on only 1,000 tons now, according to C. O. Dunlop, president. At the company's Iroquois mine, three miles northeast of Leadpoint, 1,000 ft. of tunnel work had been completed in September, and three crews were blocking out a large ore body disclosed by diamond drilling. Raises, drifts and crosscuts were being made. About 2,000 tons from this property had been trucked to the Goldfield mill during September with about 100 tons being milled daily. The first car of zinc concentrates was to be shipped to the Trail smelter on Oct. 1. The lead concentrates were to be sent to the East Helena smelter later.

★The M&C mine, southwest of Chewelah, has been changed to the Mullen mine. E. J. Mullen and Clarence J. Culler have divided the property and are operating independently. Mr. Mullen reported that another shipment was about to be sent to the smelter, and that future prospects are very encouraging.

DON'T WASTE MANPOWER!

hammering and poking arched and plugged bins, hoppers, bunkers and chutes!

APPLY *SYNTRON*

"Pulsating Magnet"

ELECTRIC VIBRATORS

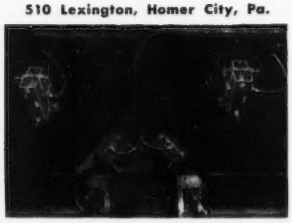
and watch the material flow!

Banged-up and dented bins and hoppers cost money in replacement and in man hours lost—and that's where SYNTRON Vibrators come in. They eliminate the arching and plugging that takes a man's time to pound, and damage, those bins and hoppers.

Write for catalog folder

SYNTRON CO.

510 Lexington, Homer City, Pa.



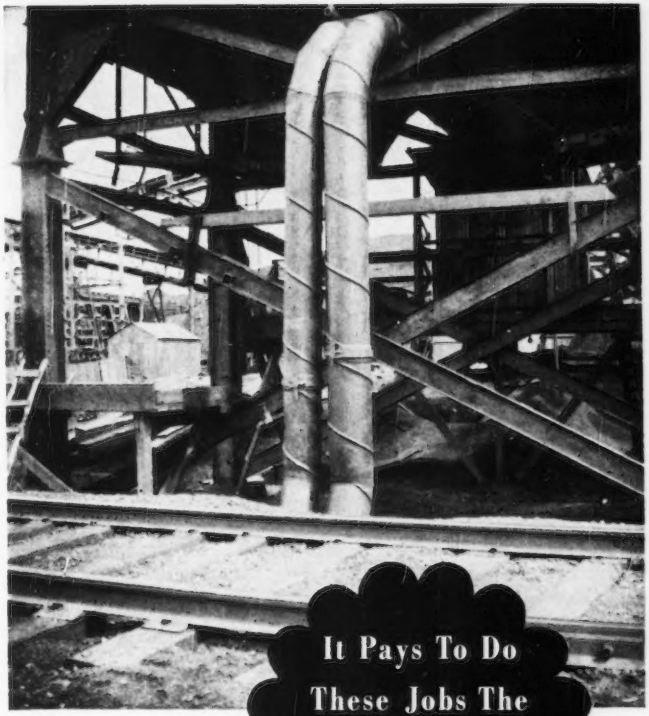
CANADA

★The increase of the Canadian gold price on September 20 to $38.50 per oz., by the series of sterling bloc and other devaluations, is regarded as a benefit to mining on a permanent basis. Base metal and iron mining will also draw strength from the Canadian dollar devaluation to the extent that substantial markets have been developed in the United States. The Canadian currency cut is expected to increase the income of many mining companies, of which the following are samples. **International Nickel Co.** should gain more than $12 million annually, since nickel is marketed chiefly in the United States. Inco net sales in 1948 amounted to $197 million, but production this year has been reduced 10%. **Consolidated Mining & Smelting Co.** of Canada may add $10 million to gross income as a result of the currency cut, based on annual sales of about $130 million. **Steep Rock Iron Mines** will benefit from a 10% jump in the price of ore sold south of the border. On the other hand, increased prices to mines and smelters will go into effect for purchases of such items as machinery, pipe, steel, oil and coal.

★The Gold Mining Assistance Act will not be extended beyond Dec. 31, 1950, according to a statement by Hon. Colin Gibson. The Act had been put into effect for three years and it would be unfair to the industry to cut short the period of benefits. The bonus is directly related to the needs of each mine so that cancellation of payments would have an unequal effect. The bonus will continue to be paid without change to the end of 1949, when the amount paid is to be reduced by $3.50 per oz. While any mines now drawing $3.50 or less in subsidy will get nothing, new legislation is planned to give aid to a larger number of marginal mines that have been ineligible for the bonus. The reduced cost in 1950 to the Federal treasury is estimated at $4.5 million. Devaluation is expected to benefit exploration efforts in Canada as a result of increasing the supply of U. S. dollars.

NOVA SCOTIA

★Great expansion has taken place in the output of industrial minerals in Nova Scotia. Total mineral production last year was valued at more than $56 million compared with $36 million in 1947. Of the total, 84% was coal, the daily output per man increasing from 1.41 tons in 1947 to 2.20 tons. This year the Provincial Department of Mines has put a coal sampling plant in operation and has also set up a new service for testing mine ropes under actual operating conditions, in conjunction with the Nova Scotia Research Foundation. Gypsum mining has increased 38% to almost 3 million tons, which repre-



It Pays To Do These Jobs The NAYLOR Lightweight Way

You get the advantages of lightweight lines when you use Naylor Pipe. Its distinctive Lockseam Spiralweld structure produces pipe that is light in weight yet provides the strength and safety required in mining service. Add to this performance the speed and economy of Naylor Wedge-Lock Couplings and you have a combination not found in ordinary lightweight pipe.

Sizes from 4 to 30 inches in diameter—thicknesses from 14 to 8 gauge. All types of fittings, connections and fabrications.

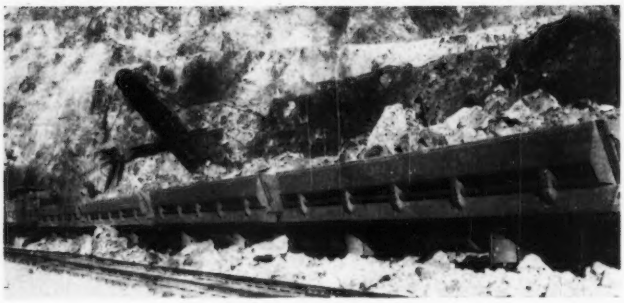
Write for Catalog No. 44.

Specify NAYLOR PIPE for These Applications

AIR LINES—high or low pressure
WATER LINES—high or low pressure
HYDRAULICKING
DRAINAGE
SUCTION LINES
SLUDGE LINES
VENTILATING LINES

Naylor Pipe

NAYLOR PIPE COMPANY
1243 East 92nd Street, Chicago 19, Illinois
New York Office: 350 Madison Avenue, New York 17, N. Y.



Differential Air Dump Cars

Differential design and construction is preferred by operating men because of such important features as:

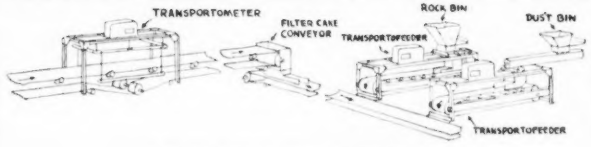
Automatic 2-Way Air Dumping, Safe and Quick Dumping, Sturdy Construction with Light-weight, Automatic Down Folding Doors, Superb Workmanship, Long Life, Low Maintenance.

●

Mine Cars • Locomotives • Dumping Devices
Rock Larries • Complete Haulage Systems

●

DIFFERENTIAL STEEL CAR COMPANY
FINDLAY, OHIO
Pioneer Builders of Haulage Equipment Since 1915



CONTINUOUS PROPORTIONING
AUTOMATIC WEIGHING, INDICATING, INTEGRATING,
TOTALIZING AND FEED RATE REGULATING

SINTERING MACHINERY CORP. — **70 PINE ST.**
Transportometer Division — New York 5, N. Y.

Canada *(Continued)*

sents 92% of Canada's total recovery of this mineral. A new crushing plant rated at 800 tons per hour has been installed by one of the major gypsum operators.

Known reserves of barytes in Nova Scotia exceed 2 million tons. In addition to the major deposit at Walton, Hants County, production is expected to be started next year from the Brookfield deposit in Colchester County. Salt production last year exceeded $63,000 tons, including Nappan brine and Malagash rock salt. Harold Leverin, consulting engineer, is engaged in sampling all peat deposits in the province, including those located through the study of aerial photographs. The mobile mining plant of the Department of Mines, powered by two diesel electric units, has been used at the Gay's River gold mine to dewater, clean out, and bulk sample three adits and two slopes. Gold production in Novia Scotia has reached the lowest in the long record of Nova Scotia mining history.

ONTARIO

★The number of producing gold mines in the Kirkland Lake camp was reduced to 8 in July, when the Bidgood property closed down. In the Porcupine area 16 mines remained active, and 9 in the Patricia district. Thunder Bay has 5 producing gold mines and there are two each in Larder Lake and Matachewan. The Sudbury district has one gold producer, the Renabie. Gold output for the province in July was valued at $6.6 million, 10.7% above the same month in 1948. Tons milled in the same period increased 19.5%.

★The conciliation board appointed by the Ontario Minister of Labor has given a majority report which was accepted in settlement of a wage dispute between the **International Nickel Co.** and Local 598 of the IUMMSW (CIO). The men receive a 6½ c. per hour wage increase dated back to June 1, two extra paid holidays a year, and some minor concessions. A 50-c. increase in dues was also voted by union members. The Inco agreement removes the strike threat and is also expected to lead to a settlement with the Falconbridge mine, where negotiations had been interrupted until the Inco discussions were completed.

★D. M. Hogarth, president of **Steep Rock Iron Mines,** has announced financing arrangements to permit expanding production to 4 million tons a year between 1952 and 1954. The ultimate aim is now stated to be 10 million tons a year. The sale of preferred and common stock has supplied $3 million and the Export-Import Bank has provided a 4½% first mortgage loan of $5 million. Funded debt amounting to $12.2 million is to be paid off by 1955. The Canadian steel industry now requires 4 million

tons of iron ore annually but is expected to increase within the near future to 5 or 6 million tons. Production this year at Steep Rock is estimated at 1,200,000 tons, to provide a net profit of possibly $1.5 million.

★The Theano Point property of **Camray Mines**, located on the north shore of Lake Superior, in August reported the discovery of a new pitchblende zone. High readings on a Geiger counter were obtained along a distance of 300 ft. The No. 1 zone is being opened by a two-compartment incline shaft. Early in September this had reached a depth of 80 ft. and plans have been announced to continue underground work through the winter.

★G. A. McKay, mine manager of **Leitch Gold Mines**, reports that development is being concentrated on the bottom level at 2,875 ft., three levels below the diabase sill. A long crosscut is being directed to intersect the No. 1 and No. 4 veins. The company is working to an objective of 2,300 oz. per month, an increase of 300 oz. Above the 15th level the mine has ore reserves estimated to be adequate for 5½ years.

★John A. Reed, consulting engineer, has recommended the property of **Lunward Gold Mines**, located southwest of Sioux Lookout, as warranting extensive underground exploration. Arrangements have been announced for providing $200,000 to sink a shaft to 226 ft. and to carry on 2,000 ft. of lateral work and 4,000 ft. of diamond drilling. Three ore zones have been described, of which the No. 1 shows 1,358,700 tons averaging 0.173 oz. per ton.

MANITOBA

★**Nor-Acme Gold Mines Ltd.**, operated by **Howe Sound Exploration Co.**, is now operating at 2,000 tons per day. With operations on a normal basis, reports on production and earnings are expected to be made in the near future.

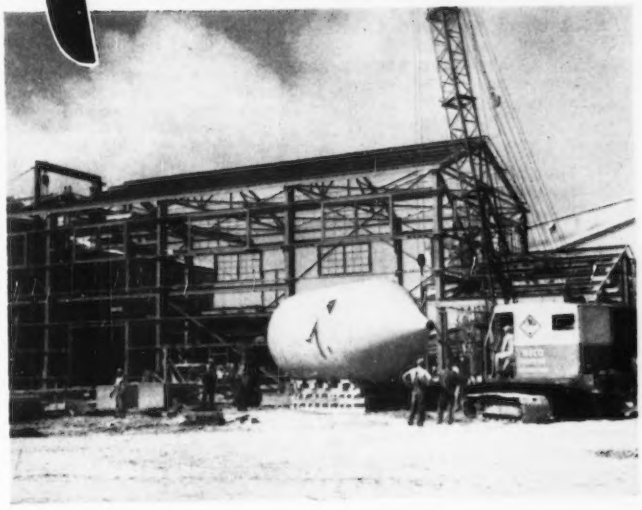
★**Ogama-Rockland Gold Mines Ltd.** reports that diamond drilling below the 700-ft. level has intersected a new vein close to the main shaft at the 930-ft. horizon. Two drill holes returned good values across 4 ft. Production for the month of July amounted to $45,543 from 4,113 tons milled, an average recovery of $11.07 per ton. Since the beginning of this year $115,000 has been repaid to **Gunnar Gold Mines** on a recent loan. A balance of $460,000 remains to be paid.

★**Winnipeg River Tin Mines Ltd.** whose property lies 12 miles northeast of Pointe du Bois, Manitoba, has granted an option to the Hollinger Consolidated Gold Mines Ltd., for the examination of its property. During recent years surface work has revealed the occurrence of beryl, lithium minerals and indications of radio-

ARE YOU PLANNING

★ PLANT ENLARGEMENT?

★ PLANT MODERNIZATION?



The mining industry is faced with (1) increasing demands for special products, (2) changing characteristics of ore bodies. To take full advantage, plants must be enlarged and equipped for new processes—to get more efficient recovery of values and cheaper application of power.

Stearns-Roger offers you 64 years of "know-how" gained thru engineering, designing, and constructing metallurgical, chemical processing, and power plants...together with ample manufacturing facilities for producing much of the special equipment required.

Stearns-Roger

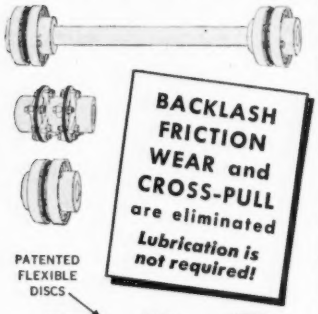
THE STEARNS-ROGER MFG. CO. DENVER COLORADO

THOMAS
Flexible ALL METAL COUPLINGS
FOR POWER TRANSMISSION
REQUIRE NO MAINTENANCE

Patented Flexible Disc Rings of special steel transmit the power and provide for misalignment and end float.

Thomas Couplings have a wide range of speeds, horsepower and shaft sizes:
½ to 40,000 HP
1 to 30,000 RPM

Specialists on Couplings for more than 30 years



THE THOMAS PRINCIPLE GUARANTEES PERFECT BALANCE UNDER ALL CONDITIONS OF MISALIGNMENT.

NO MAINTENANCE PROBLEMS.

ALL PARTS ARE SOLIDLY BOLTED TOGETHER.

Write for the latest reprint of our Engineering Catalog.

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA

Canada *(Continued)*

active minerals on the property.

★**Forty-Four Mines Ltd.** reports that the new 26th level at **San Antonio Gold Mines Ltd.** has crossed the Forty-Four line and shows a good width of basalt, the host rock for ore at San Antonio. The 18th level at San Antonio will also be extended over the boundary.

★**Callinan Flin-Flon Mines Ltd.** has acquired a 51% interest in a group of eight claims adjoining east of **Eldorado Mining & Refining Co.** in the Goldfields, Lake Athabaska district of Saskatchewan. A program of surface prospecting has been started and sufficient funds are reported on hand to complete the present work. The company's main property adjoining Hudson Bay Mining & Smelting Co. at Flin Flon is being retained. Drilling carried out on the main property last year was inconclusive as regards base metal possibilities, though some significant gold values were obtained.

BRITISH COLUMBIA

★Revival and new development of properties in British Columbia's "Silvery Slocan" is continuing, with predominately United States capital taking over a half-century-old silver-lead-zinc operation on Woodbury Creek, near Ainsworth. The group, Harry F. Kenward and associates, has secured an option to buy the Budweiser and Amazon claims, including the Bell fraction. These claims extend up the creek 3,000 ft. above the property now under development by **Privateer Mine, Ltd.** A report has been obtained from A. St. Clair Bindle, consulting engineer, following a recent examination, and equipment purchased for further development of the property. Ore to be concentrated averages 3.0 oz. silver per ton, 12% lead and 2% zinc. In addition there is considerable high-grade material assaying 18.0 silver per ton, 67% lead and 4% zinc which will be shipped directly to Trail smelter for treatment.

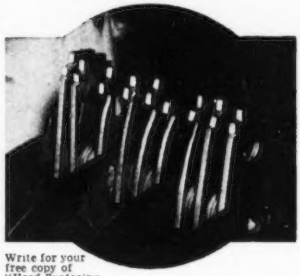
★True Fissure mine, near Ferguson in the Lardeau area, equipped with a 75-ton mill and hydro plant, is being returned to productivity by **Columbia Metals Corp., Ltd.**, of Ontario. Former owners established an ore reserve of 67,000 tons averaging 0.044 oz. gold, 6.9 oz. silver, 6% lead and 6.7% zinc, with some cadmium. David A. Sloan, mining engineer, advises that there is at least two years' supply of ore for the present mill above the second level, with a possible ore shoot 260 ft. long on the third level. A second shoot 240 ft. long was indicated near the southern end of the third level.

★Another former B. C. metal producer in the Slocan may benefit by today's high prices. At Sandon, **Carnegie Mines, Ltd.**, Montreal, has taken over, under option, holdings of

FOR HARD FACING AND REPAIR

Amsco®
WELDING PRODUCTS

TUNGSITE Tungsten Carbide INSERTS



Write for your free copy of "Hard Surfacing by Fusion Welding."

FOUR WEEKS—*instead of only four days*—now that these hammers are tipped with Amsco Tungsite Inserts! Imagine how this 600% longer hammer life, with its reduction in machine repair and down time, has cut the costs of pulverizing asphalt roofing trimmings.

Amsco Tungsten Carbide welding products are available as Inserts . . . or as Tungrod and Tube Tungsite hardfacing rods and electrodes. To meet all job needs . . . Inserts are available in a wide range of shapes and sizes . . . and Tungrod and Tube Tungsite are supplied in a variety of mesh sizes. Recommended for resistance to extreme abrasion, or when a serrated cutting edge is required. Outstandingly successful on rotary drill bits, plowshares, cane knives, muller plows, pug mill knives, hammermill hammers and similar parts.

AMERICAN Brake Shoe COMPANY
AMERICAN MANGANESE STEEL DIVISION

376 E. 14th St., Chicago Heights, Illinois
Offices in Principal Cities

Silversmith Mines, Ltd. Preliminary rehabilitation work is under way and samples are being sent to the federal mines department at Ottawa for assay. The Silversmith holdings, amalgamation of the Silversmith, Slocan Star and Silver King properties, are equipped with a 125-ton mill, nine power sites and a complete mining plant. Carnegie plans an extensive development program.

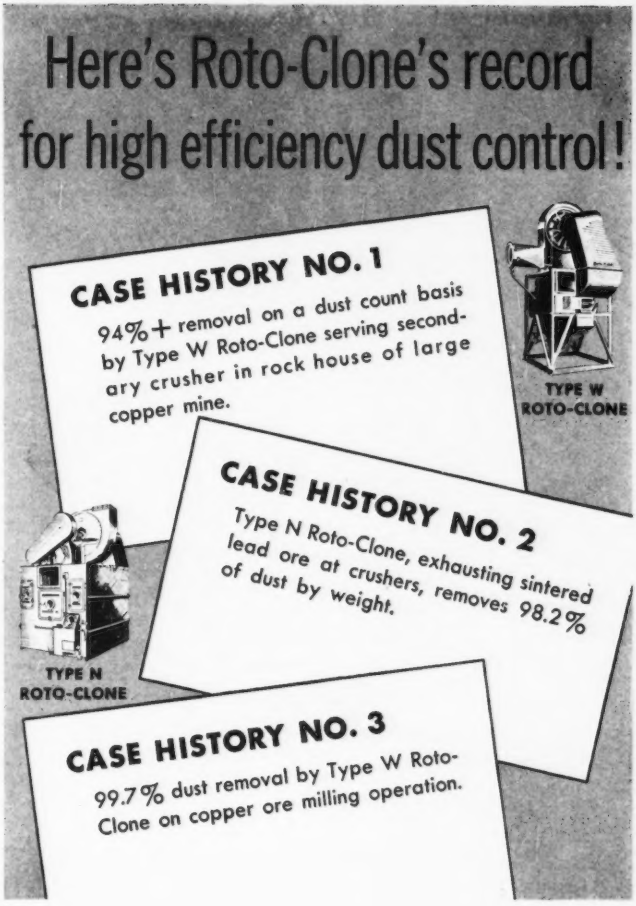
★A new company, **Promistora Gold Mines, Ltd.**, has been formed to develop a gold-silver group of 17 claims near Burton at the north end of Lower Arrow Lake. Stripping of the main vein for 120 ft. has revealed good values in the first 60 ft., lesser values at the far westerly end. Assays run from 6.74 oz. gold and 9 oz. silver to .24 oz. gold and .80 oz. silver.

★Spider Mine at Camborne in the Slocan-Lardeau country, has returned to production, following consolidation of assets of **Winslow Mines** with **Sunshine Lardeau Mines.** Mine Manager Walter Scorgie reports a carload of ore has been shipped to Trail smelter. The Winslow mill will be moved to the Spider property. Company management believes accumulation of ore in the dumps will show values well above mill grade. In addition, a considerable tonnage of ore has been developed in place in tunnels and other workings on the No. 1 vein and is expected to furnish mill feed for a considerable period.

★**Canam Mining Corp., Ltd.**, has commenced a diamond-drilling program on its property 27 mi. east of Hope to gain more depth and length on an ore showing. One heavy drill is being used. The initial hole will run from the 600-ft. level, directed downward at a 60-deg. angle to test a wide copper-gold-silver ore occurrence 200 to 250 ft. deeper. This orebody has been traced for about 2,000 ft. on the surface and to date located in four crosscuts and one effective diamond-drill hole down to the 600-ft. level. Copper values averaged better than 1.5% for a true width of 80 ft. with gold and silver also present.

★**Kenville Gold Mines, Ltd.**, reports encouraging results from two new veins discovered by bulldozer stripping in the past season on the Arlington property at Erie, B. C. Following virtual closing of Kenville's original property and the operating of the Kenville mill on a customs basis to handle ore from the Van Roi mine, the Kenville company took an option on the Arlington, some 25 mi. from the Kenville mill. Several truck shipments of ore from surface workings have averaged better than 1 oz. in gold per ton, after some sorting.

★A large body of high-grade ore has been struck at the **Society Girl Mine** near Moyie, operator M. Nicholson reports, and additions to the present crew are to be made. The Society Girl has shipped several carloads of silver-lead ore in recent weeks.


Here's Roto-Clone's record for high efficiency dust control!
CASE HISTORY NO. 1
94%+ removal on a dust count basis by Type W Roto-Clone serving secondary crusher in rock house of large copper mine.
TYPE W ROTO-CLONE
CASE HISTORY NO. 2
Type N Roto-Clone, exhausting sintered lead ore at crushers, removes 98.2% of dust by weight.
TYPE N ROTO-CLONE
CASE HISTORY NO. 3
99.7% dust removal by Type W Roto-Clone on copper ore milling operation.

HOW much efficiency will your dust control dollars buy? Here are just a few typical Roto-Clone* performance records in the mining field. Sound reasons why an ever-increasing number of these units are being used to service all ore crushing, screening and allied dust-producing operations.

Roto-Clone's other advantages are compact design for small space requirements; constant exhaust volume; continuous, trouble-free operation with only routine maintenance and attention. There's a size and type of Roto-Clone to solve every dust control problem. Write today for product literature and name of your nearest AAF representative.

AMERICAN AIR FILTER COMPANY, INC.
193 Central Avenue, Louisville 8, Ky.
In Canada: Darling Bros., Ltd., Montreal, P. Q.

AAF
ROTO-CLONE
DUST CONTROL EQUIPMENT

*Roto-Clone is the trade mark (Reg. U.S. Pat. Off.) of the American Air Filter Company, Inc., for various dust collectors of the dynamic precipitator and hydro-static precipitator types.

ACIERS

Aciers à outils, inoxydables, pour barres à mines et aciers spéciaux alliés. Agents à travers le monde.

ACEROS

Aceros para herramientas, inoxidables, para minas y aceros aleados especiales. Agentes en todo el mundo.

ATLAS STEELS LIMITED
WELLAND ONTARIO CANADA
Fine Steel Makers for Thirty Years
DISTRIBUTORS THROUGHOUT THE WORLD

WHEN

you have equipment you no longer need you can find a buyer among the 16,000 paid readers of ENGINEERING & MINING JOURNAL by using the

SEARCHLIGHT SECTION

MEXICO

★Silver may again become the mainstay of Mexican mining. Higher silver prices and the promising outlook have encouraged the industry. Production for the first six months this year was 744,450 kg. This is far from the 1929 peak, but improvement over last year is expected. Higher prices abroad and the presence of a sure market, the Bank of Mexico, make silver mining more attractive.

★The Mexican mint is busy producing 200,000 50-peso gold bits and 100 million one-peso silver pieces, every ten days. In addition the mint is making about 250,000 silver coins daily, for the Chinese National Government. This is Mexico's first minting for China in 40 years. The mint will start soon on 5 million Syrian silver pounds for the Beruit Government.

★Mexico's two pioneer mining cooperatives, the Dos Carlos and the San Rafael, Pachuca, Hidalgo, are doing better though still harrassed by economic and dwindling ore difficulties. Improvement, said directors, stems from the members' practice of more and better work, pledged at emergency meetings. But debts piled up during previous administrations are a serious problem. Dos Carlos admitted the playing out of its Paricutin mine. **Cia Minera de Real del Monte y Pachuca**, S.A., now Government-administered, through its fiscal agency, the Nacional Financiera, S.A., has complained that Dos Carlos invades its orebodies.

★Foreign professional people practicing in Mexico are alarmed at news that the "professionalists law" is again scheduled for hearing by the National Legislature. This measure, based upon Constitutional Article 4, states that only Mexicans by birth can practice any profession in Mexico. Nothing has been done about the measure since it was first brought up in 1943. But, say reports, it will be heard this time in the Legislature. The law is part of that enacted 40 years ago, and still strictly enforced, that all enterprises in Mexico that rate "company" status must hire 90% native Mexicans. It is also related to the migration measure that forbids any foreigner to domocile in Mexico and perform any work for any pay, excepting employees of Governments, or investors in agriculture or industry and business that is Mexican-controlled. Foreigners may work briefly in Mexico as technicians, salesmen or entertainers.

★A 10% pay hike and other benefits ended the two-month strike at **Cia Minera Nacional's** Plomosas mine, Chihuahua.

★Word in mining labor circles is that employers will again face a pay hike demand when collective work contracts are revised early in 1950. The Government, through the Labor Min-

istry has induced mining labor leaders to hold back on pay hike demands, in most cases. But as labor expects higher living costs in Mexico next year, demanding more pay is considered inevitable.

★Important sulphur deposits recently discovered on the Isthmus of Tehuantepec are to be experimentally exploited by the **Cia. Exploradora del Istmo, S.A.**, which has been granted a concession by the National Committee for Stimulation of the Mining Industry. The Frasch system will be used. The company can work in an unlimited zone during the first five and a half years of the concession, but later its activities will be held to 6,000 hectares (13,500 acres). A royalty in sulphur must be paid the Commission and if the undertaking is a permanent success the company must first cater to Mexican users before exporting.

COLOMBIA

★Gold output during the first seven months of 1949 amounted to 221,646 oz., of which 175,828 was from alluvium deposits, 43,142 oz. from veins and 2,649 oz. from flux mixtures. About 27 oz. were found in the form of jewels and are included in the global figures. The Antioquia Department leads with 120,163 oz., followed by the Chocó with 38,724 oz., Nariño with 28,018 oz. and Cauca with 10,348 oz.

Silver output for the same period reached 65,267 oz.

CHILE

★**Madeco**, a Chilean copper fabricating company, recently inaugurated its new section for making copper tubes.

★To settle the differences between the **Chile Exploration Co.** and its employees, the Government has named a committee of three. One member will represent the Government, another the company and the third the employees.

★Two new 33-ton American locomotives bought by **Braden Copper Co.** for its railroad, have already arrived in Chile.

★Small shipments of copper have recently been made to Sweden and Italy. These nations, prior to World War II, bought appreciable quantities of copper from Chile.

★**Cía. Minera Punitaqui** has recently acquired control of **Cía. Minera Aysén** which owns some interesting high-grade lead and zinc deposits in Aysén Province in southern Chile. Cía. Minera Aysén is building a differential lead-zinc flotation mill at the mine to treat 60 tons of the lower-grade ores per day. Because of difficult transportation problems and conse-

Only a 1-Man JOB WITH A SAUERMAN POWER SCRAPER

When the job calls for digging, hauling and dumping loose materials at long range — it pays to install a Sauerman Power Scraper. Thousands of users testify that this is a sure way to cut costs — increase yardage.

Sauerman Power Scrapers dig in any type of ground — dry, wet or rocky — to deliver large loads faster and with less line pull than any other scraper.

One quickly trained man handles the entire operation. First cost is low, so is the maintenance expense.

LET US SHOW YOU — WRITE TODAY FOR LARGE CATALOG ILLUSTRATING TYPICAL INSTALLATIONS.

SAUERMAN BROS. Inc.
584 S. Clinton St. Chicago 7, Ill.

Sauerman Scraper with rapid shifting device at tail end, makes deep cut into hill and moves earth 400 ft. at rate of 2,000 cu. yd. a day to fill empty stope.

Above is a 15 cu. yd. Sauerman scraper bucket on a strip mining job where it is removing an area of overburden 60 ft. deep, 300 ft. wide and 8,000 ft. long.

Backed by 25 Years Experience with Storage Battery Locomotives

THE GREENSBURG "CRUISER"

Operators say — "20% MORE EFFICIENT than average Storage Battery Locomotives"

All Locomotives CUSTOM-BUILT to your requirements

FEATURES

2-motor drive; total 24 h.p.

Series parallel controller.

Extra long journal springs for better trackability, roadability.

Oil-tight, leakproof transmission. Use auto oil, renew once every 6 months.

Adjustable Timken Roller Bearings throughout.

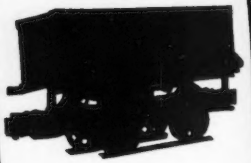
Strong. Simple construction. Low maintenance cost.

MORE HAULING FOR LESS STORAGE BATTERY CAPACITY

GREENSBURG MACHINE CO.
Makers of Custom Built Storage Battery Locomotives
102 STANTON ST., GREENSBURG, PA.

CARD CARS

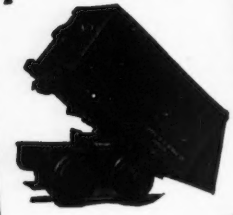
A ♠ "Deliver the goods"



A ♦ Under Severe Hauling Conditions

CARD CARS are designed to meet the special conditions in your mine. They are "engineered to the job."

A ♣ "Lowest Cost Per Ton-Mile Haul"



Ask for Catalog 40 — Today

A ♣

C.S. Card Iron Works Co.
Denver, Colorado

Chile *(Continued)*

quent high cost of freight, all ores and concentrates must be over 65% lead and 55% zinc before shipments are worthwhile.

★The price of bar-gold or gold coins continues its steady trend upwards in this country. Recently Chilean gold coins containing 0.59 oz. of fine gold reached 3.600 pesos when auctioned at the Santiago Stock Exchange, previous best price being 3.400 pesos. This record price for metallic gold was due to the fact that gold coins in Buenos Aires rose appreciably when it was announced that Argentina had gone off the gold standard. Devaluation of the sovereign likewise had a psychological influence on the Chilean Stock Exchanges. Most gold mining shares showed an appreciable rise. When the price of gold in Buenos Aires gets above that in Chile, it becomes profitable to export gold to Buenos Aires. Because of this, the price of gold coins in Santiago and Buenos Aires has kept a fairly even value if rates of exchange are taken into account.

★A very small tonnage of oxide ore is now left at the Potrerillos mine, so the leaching plant is being run below capacity. In a short time all oxidized ore will have been mined and all the copper will come from the sulphide ore of which the mill can handle 20,000 tons a day. Future production from Andes will be around 8,000,000 lb. a month.

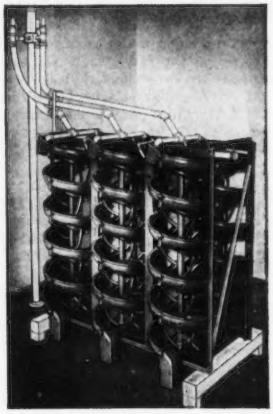
★According to the local press an important mine has been discovered in Talca Province. The orebody is said to run 50% lead, 7 oz. silver.

PHILIPPINES

★**Benguet-Balatoc.** August gold output was valued at $355,950 at the statutory prices. This was a new postwar high on value but not in tonnage milled. In August 1,610 tons per day was milled with $7.13 per ton average recovery. Manpower has increased so that the mining department can now deliver 1,800 tons daily. Men employed at Benguet total 1,857 and at Balatoc 1,358. Bullion returns in August brought $41.74 per oz. gold. This was considerably less than the price of $46.16 obtained for July bullion. Recently demand for gold has improved with sales in September at $42.60.

★**Mindanao Mother Lode.** Production in the first eight months of this year totaled $986,000 at $35 gold, compared with $1,135,380 for the whole of 1948. In August the company milled 9,900 tons averaging $15.30 per ton with value of $152,300. The August mill run was an all-time high in tonnage and a postwar high in gold recovered. Development work on the 850-ft. level confirms extension of the Tabon oreshoot to that level.

HUMPHREYS SPIRAL CONCENTRATOR



LOW COST OF INSTALLATION
NO MOVING PARTS
LOW OPERATING COST

Engineering Division
The Humphreys Investment Co.
913 First National Bank Building
DENVER 2, COLORADO

SHORTEST DISTANCE . . .

. . . *To Buying Information*

Like many another busy operating executive in the mining field, Mr. R. G. Amidon, Superintendent of Buffalo Mine, Granite, Oregon, handles the ordering of equipment and supplies for his mine. So, naturally, he is interested in the most direct way—the shortest distance—to complete, accurate Buying Information. That *way* is McGRAW-HILL PRE-FILED MINING CATALOGS, of which he said recently: *"I use it often in looking up manufacturers."*

If PRE-FILED MINING CATALOGS is not available for buying reference at your mine, write to McGRAW-HILL CATALOG SERVICE, 330 West 42nd Street, New York 18, New York. There is no charge to qualified users.

Drifting has been completed for 100 ft. Changes in the mill circuit have increased gold recovery.

★**Atok-Big Wedge.** Production for the first eight months of 1949 came to $1,485,650 at $35 gold. August production was $180,920 from milling 12,534 tons averaging $14.40 per ton. A well-known American geologist has laid out a program for development.

★**Lepanto Consolidated.** Production continues steady. In August 15,935 tons were milled averaging 4.88% copper and 0.177 oz. gold per ton, for a production of 2,358 tons of 30.2% copper concentrates and 2,068 oz. gold. Production was valued at $263,600 at Tacoma based on current metal prices.

★**Consolidated Mines.** Chromite shipments in August fell to 15,000 tons. This represents a decline of 5,000 tons from the 20,000-ton monthly average for the first half of the year. Demand for chromite from the U. S. has declined although the price is unchanged. The labor force is being reduced until orders pick up.

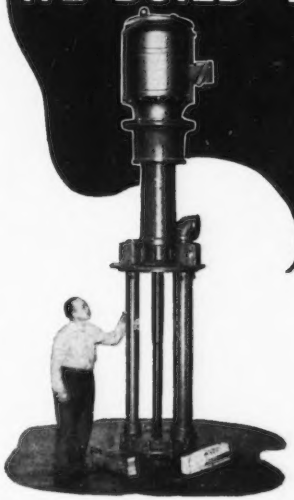
★**Surigao Consolidated.** July production was reported $95,600 in value from milling 8,624 tons averaging $11.10 per ton.

★**General Base Metal, Inc.** Shipped 2,786 tons of 45% manganese to Japan in August, with 1,000 tons left in the stockpile. Lazaro Cruz is general manager. The property is located at Anda on Bohol Island and is currently producing 1,000 tons a month by handwashing the manganese nodules. A large ore reserve is believed to exist. The same interests have opened up a sizeable manganese deposit on Negros Island.

★A new lead prospect has been developed near Batangas, opened by a shallow shaft. Galena occurs in space between pebbles of conglomerate and comprises about 15% of the latter. Concentration by hand-jigging yields 62% lead concentrates with $100 per ton in silver. The orebody is described as a plug deposit about 45 ft. in diameter in andesite porphyry.

★Vigorous appeal has been made by the Philippines Chamber of Mines to the Secretary of Natural Resources for measures to relieve the gold mining industry. A higher price for gold is not asked as this obviously depends on the monetary policy of the American Government, since the peso is tied to the dollar. Instead, suspension of the production tax on gold is requested, which bears unfairly on the industry. The compensation tax on purchases abroad of mining machinery should be lifted as well as amending the law on assessment work so as to concentrate it on a single claim. Government aid in financing development of new mines, adjustment of ocean freight rates, Government - leased lighters, freezing of present wage rates and taxes, and increased appropriations for the Bureau of Mines were also advocated.

WE BUILD 'EM *BIG* TOO !



4" Type SW-OB, frame 143M wet pit pump with motor.

NAGLE PUMPS

Want a big one? . . . want a small one? Want one to handle corrosive liquids? . . . want one to handle tough abrasive materials? You name it, and we'll build it!

Soundly engineered design and correct materials make Nagle Pumps outstanding . . . whether large or small. Note these important features of ALL Nagle Pumps: Simple adjustment, accessibility, and easy replacement of water end . . . Any condition met efficiently through proper impeller, choice of six . . . Specific type of abuse met successfully through proper material in water end.

Write for more information!

Nagle Pumps

INDUSTRIAL PUMPS FOR ABUSIVE APPLICATION

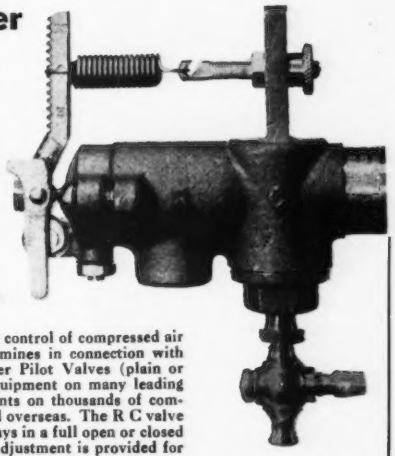
1239 Center Ave. Chicago Heights, Ill.

RC Unloader

BRASS PILOT VALVES

Plain & Strainer Type

for Air Compressors and Pumps Provided with Unloader



Here is an ideal pilot valve for control of compressed air used so extensively in metal mines in connection with rock drills. The R-C Unloader Pilot Valves (plain or strainer type) are standard equipment on many leading compressors and as replacements on thousands of compressors both in the U.S.A. and overseas. The R C valve is positive in its action—is always in a full open or closed position and cannot chatter. Adjustment is provided for any unload-to-load range from 4 to 600 lb. Maximum pressure unloads.

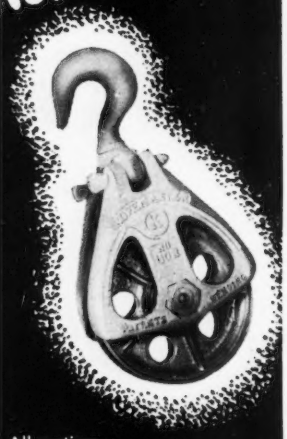
Write for price and recommendation giving air pressure and range of load and unload operation desired.

R C S
Strainer Type with drain cock

R. CONRADER CO. 1207 French St., ERIE, PA.

PILOT VALVES for Portable and Stationary Air Compressors provided with Unloaders

do a better job with the ROPEMASTER



All castings are electric steel with extra length for balance to give you the utmost in a balanced block.

Features you can't match — All engineered in this improved block. Strut reinforced ear lugs, heavy alloy forged shackle give you top performance!

Streamlined sides, with latest Timken precision assembly, plus positive grease seal, assure smooth operation.

New, large alloy pin and tubiform rigid reinforcement help cut rope costs and speed up production.

Write for prices.

Cate
EQUIPMENT CO.
49 EAST 9th SOUTH
SALT LAKE CITY, UTAH

AUSTRALASIA

★Devaluation of Australian currency by 30.5% in terms of the U. S. dollar will bring bigger profits to Australian metal mining companies, but substantial volume increases in production will be confined to relatively few metals, notably gold. Shortages of manpower, housing, mining equipment, electric power and coal place a narrow limit on output.

These shortages prevented the important lead-zinc-silver industry from responding to the high metal prices which placed a bigger premium on overseas sales for some years than the devaluation offers now. At the peak of the international metal market Australian production was still below prewar levels.

Mining companies now face the alternative of training additional labor and employing it at excessive pay rates, putting up accommodation at prohibitive cost and using such expensive makeshift equipment as they can procure locally, or of getting extra production out of the present labor force by offering incentive payments. In either case the exchange premium of 44% may be eaten up by extra costs before much extra production can be shown.

The law of diminishing returns will also assert itself because many mines have been worked for the best ore while marginal assays have been neglected. Higher metal prices resulting from the exchange premium are likely to reverse this policy. Rich veins will be left in reserve against the day when lower taxation will not penalize high profits which would result at present prices from the mining of high-grade ores.

Other Washington decisions to deal with the dollar deadlock in the sterling area will not be of any more help to Australian metal mining as far as volume of production is concerned. The limiting factor in dollar earnings has not been American tariffs or America's inability to pay Australia's prices, but the failure of Australian production to expand. Even strategic stockpiling of Australian-produced metals can therefore not accelerate the flow of minerals.

American offers to assist in the development of sterling area resources with direct capital investments were not made for the first time at Washington. The present Australian government is definitely not interested in these overtures. No progress has been made on the conclusion of an U. S.-Australian agreement on the disposal of the double taxation problem that confronts American firms in Australia.

NORTHERN TERRITORY

★The small mining town of Tennant Creek declared a public holiday when the slump in the £-$ exchange rate

"FIRST IN THE FIELD"
WEDGE-WIRE Aluminum VIBRATOR SCREENS

The cross-section above shows how KLEENZLOT screens operate on a non-clogging, non-blinding principle.

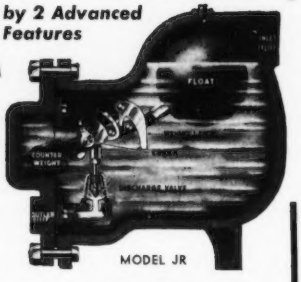
THOROUGHLY TESTED AND PROVEN IN ACTUAL TESTS

Here is a new type of vibrator screen that is receiving acclaim wherever it is used. Like all Wedge Wire Screens, it is precision-made of quality materials and will give long life and perfect performance. WEDGE WIRE Screens will help maintain the efficiency of your preparation plant.

SEND FOR COMPLETE LITERATURE & DATA

Wedge-Wire CORPORATION
5602 CLARK AVE. CLEVELAND 2, OHIO

Nicholson Air Traps Assure
Positive Drainage of Aftercoolers
by 2 Advanced Features



MODEL JR

1) Positive Fluid Seal Over Discharge Valve—Solves problem of loss of air in drainage of aftercoolers, intercoolers, separators, receivers, etc.

2) Extra Large Discharge Capacity—Valve opens and closes instantaneously, in rapid intermittent action. 3 types for press. to 1,500 lbs. CATALOG 448.

W. H. NICHOLSON & CO.
201 Oregon St., Wilkes-Barre, Pa.

became known. The 44% premium on the gold price has brought dozens of low-grade workings within the scope of profitable production.

★**Peko (Tennant Creek) Gold Mines, N. L.,** has been registered in Melbourne with £100,000 capital to purchase an option over the Peko lease and adjoining leases. The prospectus states that 19,000 tons of 16½ dwt. have been proved. A shaft has been sunk to 210 ft. and it is intended to develop the mine at this level.

★Mica miners who found deposits of a radioactive ore at Hart's Ranges will receive a reward of £250 for the discovery, it was announced by the Minister for Supply and Development. This is a far cry from the £25,000 reward promised for the discovery of deposits capable of yielding commercial quantities of uranium.

★Two geologists from the Bureau of Mineral Resources have gone to Rum Jungle to make an appraisal of another uranium find. The discovery was reported from an abandoned copper mine only 10 miles off the main road to Darwin.

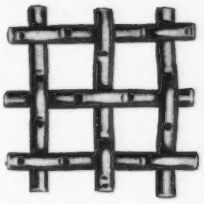
WESTERN AUSTRALIA

★Apart from the renewed confidence in the future of the gold fields, there does not seem to be an immediate prospect of big developments following the increase in the Australian price of gold from £10/15/3 to £15/9/10. On the other hand, such marginal mines as **Paringa** and **South Kalgurli** on the Golden Mile, **Sons of Gwalia** at Leonora and **Big Bell** on the Murchison field have been given a new lease of profitable life. Shortage of labor and the slow supply of mining machinery will delay the opening up of such promising properties as **Porphyry** and the **Western Mining** holdings in the Yilgarn field. The Kalgoorlie correspondent of the **West Australian** believes that work is likely to be pushed ahead on the **Mount Charlotte** mine, on the eastern boundary of the Kalgoorlie townsite. Extreme shortage of trucks and gasoline is a bar to the revival of prospecting.

★Average grade of ore treated last year was 5.41 dwt. With the higher price for gold in local currency, it is estimated that the same profits could be earned on ore of 4 dwt. assay. Treatment of lower-grade ore removes the need for costly selective mining. At least one mining executive is reported to be dissatisfied with the 44% rise in returns. This is Mr. P. F. Cody, chairman of **Great Boulder,** whom the Melbourne *Sun* quotes saying that only a higher valuation of gold in terms of the U. S. dollar, as advocated by South Africa, will inspire confidence of a more definite and permanent nature. There is, of course, a lot to be said for a higher dollar price of gold as a means of earning more dollars without producing more gold.

Cut Milling Costs with CF&I WIRE CLOTH and GRINDING BALLS

CALWICO CF&I WISSCO WIRE CLOTH



Calwico-Wissco wire cloth is available in sizes from fine filter cloth to 5-inch space cloth . . . made in bright or galvanized steel, brass, copper, bronze, monel, aluminum, stainless steel, and other metals . . . for use on filters and vibrating, revolving, and stationary screens.

Thus, you can get the best wire cloth for each particular application in your milling operation . . . the wire cloth which will help you cut your milling costs.

CF&I FORGED STEEL GRINDING BALLS

CF&I FORGED STEEL GRINDING BALLS are hot-forged of tough, abrasion-resisting steel and carefully heat treated for uniform wearing qualities. There are no soft spots; thus they stay round, providing maximum grinding efficiency through their long life . . . and cut your grinding costs.

OTHER CF&I PRODUCTS FOR THE MINING INDUSTRY: Wickwire Rope, Grinding Rods, Rowlock Fence, Clinton Welded Wire Fabric, Grader Blades and other Cutting Edges, Mine Rails and Accessories.

The Colorado Fuel and Iron Corporation

GENERAL OFFICES: DENVER, COLORADO

IN THE EAST: THE WICKWIRE SPENCER STEEL DIVISION, NEW YORK CITY, NEW YORK

IN THE WEST: THE CALIFORNIA WIRE CLOTH CORPORATION, OAKLAND, CALIFORNIA

TASMANIA

★Profit of **Aberfoyle Tin, N. L.,** for the year ended June 30 dropped by £26,464 to £50,926. From treatment of 25,362 tons (28,002 tons in 1947-48), 326 tons (379 tons) of first grade tin concentrates, 27.7 tons (23.8 tons) of second grades, 71.3 tons (56.9 tons) of slimes and 90.4 tons (83.4 tons) of wolfram concentrates were recovered. Ore reserves at the end of the report year were estimated at 110,832 tons proved ore and 34,640 tons probable ore.

Directors report that the continuance of ore veins at depth had been proved by diamond drilling. The new ore bodies will permit the opening of two more levels below the recently developed levels, No. 7 and No. 8.

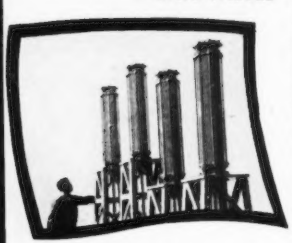
NEW SOUTH WALES

★Following the protracted mid-year coal strike, steel production was resumed on August 15. Practically nothing was produced in July, following reduced operations throughout the month of June.

Iron ore shipments from South Australia were also resumed in August, but no pig iron was produced at

Ledeen heavy duty cylinders helped do this job better

OPERATING
REFINERY
GATE VALVES



APPLICATION—The 8" diam. x 36" stroke Ledeen heavy duty cylinders, illustrated here, are used to operate 24" and 30" diam. gate valves carrying hot oil. Refinery layout makes remote control necessary. Controlled from the central point Ledeen cylinders provide instant and easy action of all gate valves.

INSTALLATION—These cylinders operate hydraulically, connected to a 500 p.s.i. pump and reservoir. Attached to derrick-type brackets, this assembly in turn is mounted on the gate valves. Piston rods of cylinders are connected to extension rods that go into valve gates.

Perhaps you too have a job that can be improved by Ledeen heavy duty cylinders.

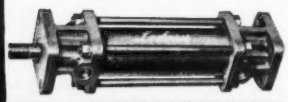
Wherever you have to...

PUSH OR PULL, LIFT OR LOWER, PRESS OR SQUEEZE, TILT OR TURN, OPEN OR CLOSE,

Ledeen heavy duty cylinders, operated by air, oil or water, will do it for you better and surer.

Standard Ledeen Cylinders with rod or head attachments are available from distributors' stock in major cities. Special cylinders on order.

Write for Bulletin 453.



Ledeen Mfg. Co.
DIV. OF ENGINEERING PRODUCTS CO.
1604 SO. SAN PEDRO - LOS ANGELES 15, CAL.

LEDEEN CYLINDERS ARE GOOD CYLINDERS • LEDEEN CYLINDERS ARE GOOD CYLINDERS • LEDEEN CYLINDERS ARE GOOD CYLINDERS

Australasia *(Continued)*

Whyalla. Australian pig iron production for August was 39,600 tons.

★From the close of the financial year to August 16 (20 weeks), **Central Norseman Gold Corp.** treated 54,630 tons of ore for a recovery of 6.36 dwt. per ton. The main features of the year's program have been the sinking of the new main shaft and additions to plant. It is hoped to begin drawing ore through the new shaft in November. A new milling plant is being installed to bring output up to 12,000 tons per four weeks.

★The labor angle in the gold production drive is underscored in the annual report of **Sons of Gwalia, Ltd.** Due to the drift of mine workers to larger cities the volume of ore treated fell from 92,000 to 67,000 tons. The firm was compelled to recruit 67 miners in Italy.

★Consolidated profit by **Zinc Corporation, Ltd.,** and subsidiaries for 1948 was £567,652 stg., compared with £404,469 stg. in 1947. Developed ore reserves increased by 200,000 tons of lead lode and 10,000 tons of zinc lode to 4,700,000 tons and 410,000 tons respectively.

QUEENSLAND

★Profit earned by **Mount Morgan, Ltd.,** in 1948-49 was £128,494, an increase of £82,124 over the previous year. Smelter production for the year was: Copper, 3,744 tons (2,648 tons in 1947-48); gold, 62,515 oz. (44,035 oz.); and silver, 17,235 oz. (15,250 oz.)

Sulphide ore reserves at the end of the report year were estimated at 5,212,406 tons.

The mill treated 770,250 tons of sulphide ore (572,320 tons) for an average of 0.54% copper (0.56%) and 2.38 dwt. (2.29 dwt.) of gold.

★Some Australian shareholders in **Mount Isa Mines, Ltd.,** have criticized the proposed redemption of all of the company's second "B" 6% and part of the first "B" 8% debentures. The debentures are to be exchanged for ordinary stock. The objection to this plan is that dividend payments on the new stock might exceed the interest liability on the debentures, to the detriment of old stockholders and to the benefit of the debenture holders, **American Smelting & Refining Co.** and its affiliate, Mining Trust, Ltd.

★A dismantled 1,500-ton dredge to be shipped from New Zealand to Cairns will be the second dredge to operate on the Mt. Garnet tin field in North Queensland. A new £350,000 company, **Ravenshoe Tin Dredging,** is being established to operate the dredge. The properties to be worked on Battle and Nettles creeks, tributaries of the Herbert River, are said to compare favorably with most Malayan leases and to be suitable for large-scale bucket dredging. The New Zealand dredge ceased operations four years ago and has since lain dismantled at Barrytown, South Island.

Recognized Universally as the ULTIMATE in Valves and Couplings

KNOX MANUFACTURING CO.

222 W. Clinton Ave. Oaklyn, N. J.

SINCE 1911 PRODUCERS OF

Valves - Couplings - Nipples - Clamps - Menders

KNOX

NEW GUINEA

★A new company, **Yonki Creek Gold N. L.,** has been formed to purchase leases on the Yonki and Ornapinka creeks, in the Kainantu district, and to bring additional plants into production. The mine is at present equipped with two hydraulic sluicing plants, water races, two jet elevators, sluice boxes and staff buildings.

★**Mandated Alluvials N. L.** expects to prove at least 1,500,000 tons of payable ore at the company's Port Moresby leases. Samples of the tin ore have been sent to Canada for treatment. It has been found that the ore is amenable to flotation.

★With No. 3 dredge out of commission through August, **Bulolo Gold Dredging Co., Ltd.,** handled 1,119,999 yards of gravel with the remaining six dredges for a total recovery of 6,082 oz. of fine gold valued at $35 per oz. In July, when eight dredges were operating, recovery was 7,959 oz. valued at $278,565 from 1,354,800 yds. No. 1 dredge was permanently closed down July 28 after completing the digging of the area for which it was designed. No. 3 dredge was temporarily out of commission for repairs to the digging ladder.

NEW SUBSCRIPTION ORDER CARD

Send ENGINEERING AND MINING JOURNAL for
THREE YEARS at $5. Mail invoice.

(Check here ☐ if you prefer only One Year at $3.)

Name .....
Street and No. .....
City ..... Zone # ..... State .....
Company ..... Your position .....

CANADIAN RATES
1 Year — $ 5
3 Years — $10

LATIN AMERICAN RATES
1 Year — $ 5
3 Years — $10

FOREIGN RATES
1 Year — $15
3 Years — $30

J11-49

Send ENGINEERING AND MINING JOURNAL for
THREE YEARS at $5. to:

Name .....
Street and No. .....
City ..... Zone # ..... State .....
Company ..... Title .....
(Check here ☐ if only One Year at $3. is desired)

Send Bill to:

Name .....
Street .....
City ..... Zone # ..... State .....

CANADIAN RATES
1 Year — $ 5
3 Years — $10

LATIN AMERICAN RATES
1 Year — $ 5
3 Years — $10

FOREIGN RATES
1 Year — $15
3 Years — $30

J11-49

nding keeps power
.. and MESCO rail
arantee perfect
IESCO
event
eaks"
e full
y at all
types
ry re-
Write

Type M8-F

Electric & Supply Co.
on Avenue Pittsburgh 3, Pa.
HEmlock 8332

POWER BUG
The Portable Light Plant
. . . 110 VOLT ELECTRICITY
ANYWHERE . . . ANYTIME!

Here's a completely new, lightweight, portable electric generator unit that meets all your small-power needs! This 110-volt generator with permanent-magnet rotor will run under full short circuit without harm to engine or generator.

FEATURES:

LIGHT WEIGHT . . . only 28 lbs. complete.

ECONOMICAL . . . Eight hrs. operation on gal. of gas means your electricity costs about 6c per kw. hr.

MANY-PURPOSE . . . Supplies all current needed to run lights, radio, soldering irons, etc.

The POWER BUG is an exclusive product of GICO. Write us without delay for full details and endless number of uses.

GICO 1820 N. NASH ST. ARLINGTON, VA.

to get 170,000 yen per ton or the price it would cost to import copper from the U. S., although Japan at present is exporting, not importing.

As an alternative, they have asked for the U. S. market price translated into yen at the current official exchange rate. This would figure out to about 140,000 yen per ton.

Failing to get this latter "compromise," copper producers will drag out a third proposal that the government pay 120,000 yen per ton, the price which they estimate Japan would get if freely exporting.

The Japanese Mining Industry Association states that if higher prices are not artificially established many producers will have to shut down. However, they also admit the big producers would get the major share of the benefits, and that these companies are now producing large quantities of electrolytic copper from scrap.

INDIA

Two of the four mines in the Kolar Gold Field, Mysore, have issued annual reports for 1948.

Mysore produced 54,629 fine ozs. of gold from 168,720 long tons of ore, an increase of 3,808 long tons in ore 10,586 dwt. a ton respectively. The government had investigations made on the facts mentioned in the press statement, and although the investigation is not yet finished, it deemed it necessary in the interests of prospective investors in the Union and abroad to disclose that it was satisfied the gold content of each of the three ore samples had been fraudulently increased before it was assayed.

★The fact finding commission which investigated conditions of employment in the gold mining industry has reported to the government. It found that if the Mine Workers' Union's demands for a 30% wage increase and the other conditions were granted, it would cost the industry another £3,687,000 a year or 15.9d. more a ton milled. A 12% increase would mean an extra £1,894,000 yearly or 8.2d. per ton milled. If there were no wage increase but the improved leave and pension claims were granted the extra cost would be £614,000 or 2.7d. a ton milled.

Notwithstanding the findings of this commission, the Mine Workers' Union intends pressing for a 30% wage increase. They consider that some of the increased revenue which will come to the producers as a result of devaluation should go to them.

FIRST CLASS
PERMIT No. 64
(Sec. 34.9, P.L.&R.)
NEW YORK, N. Y.

BUSINESS REPLY CARD
No Postage Stamp Necessary If Mailed in the United States

4c.-POSTAGE WILL BE PAID BY—

ENGINEERING AND MINING JOURNAL
330 WEST 42nd STREET
NEW YORK 18, N. Y.

FIRST CLASS
PERMIT No. 64
(Sec. 34.9, P.L.&R.)
NEW YORK, N. Y.

BUSINESS REPLY CARD
No Postage Stamp Necessary If Mailed in the United States

4c.-POSTAGE WILL BE PAID BY—

ENGINEERING AND MINING JOURNAL
330 WEST 42nd STREET
NEW YORK 18, N. Y.

Ledeen heavy duty helped do

OPERATING
REFIN

APPLICATION—1 stroke Ledeen hea lustrated here, are and 30" diam. gat oil. Refinery layou trol necessary. Ca tral point Ledeen instant and easy valves.

INSTALLATION—TI hydraulically, con pump and reservoir. Attached to derrick-type brackets, this assembly in turn is mounted on the gate valves. Piston rods of cylinders are connected to extension rods that go into valve gates.

Perhaps you too have a job that can be improved by Ledeen heavy duty cylinders.

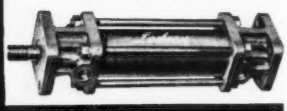
Wherever you have to...

PUSH OR PULL, LIFT OR LOWER, PRESS OR SQUEEZE, TILT OR TURN, OPEN OR CLOSE,

Ledeen heavy duty cylinders, operated by air, oil or water, will do it for you better and surer.

Standard Ledeen Cylinders with rod or head attachments are available from distributors' stock in major cities. Special cylinders on order.

Write for Bulletin 453.



Ledeen Mfg. Co.
DIV OF ENGINEERING PRODUCTS CO
1604 SO. SAN PEDRO - LOS ANGELES 15, CAL.

LEDEEN CYLINDERS ARE GOOD CYLINDERS • LEDEEN CYLINDERS ARE GOOD CYLINDERS • LEDEEN CYLINDERS ARE GOOD CYLINDERS

the report year were estimated at 5,212,406 tons.

The mill treated 770,250 tons of sulphide ore (572,320 tons) for an average of 0.54% copper (0.56%) and 2.38 dwt. (2.29 dwt.) of gold.

★Some Australian shareholders in **Mount Isa Mines, Ltd.**, have criticized the proposed redemption of all of the company's second "B" 6% and part of the first "B" 8% debentures. The debentures are to be exchanged for ordinary stock. The objection to this plan is that dividend payments on the new stock might exceed the interest liability on the debentures, to the detriment of old stockholders and to the benefit of the debenture holders, **American Smelting & Refining Co.** and its affiliate, Mining Trust, Ltd.

★A dismantled 1,500-ton dredge to be shipped from New Zealand to Cairns will be the second dredge to operate on the Mt. Garnet tin field in North Queensland. A new £350,000 company, **Ravenshoe Tin Dredging,** is being established to operate the dredge. The properties to be worked on Battle and Nettles creeks, tributaries of the Herbert River, are said to compare favorably with most Malayan leases and to be suitable for large-scale bucket dredging. The New Zealand dredge ceased operations

NEW GUINEA

★A new company, **Yonki Creek Gold N. L.**, has been formed to purchase leases on the Yonki and Ornapinka creeks, in the Kainantu district, and to bring additional plants into production. The mine is at present equipped with two hydraulic sluicing plants, water races, two jet elevators, sluice boxes and staff buildings.

★**Mandated Alluvials N. L.** expects to prove at least 1,500,000 tons of payable ore at the company's Port Moresby leases. Samples of the tin ore have been sent to Canada for treatment. It has been found that the ore is amenable to flotation.

★With No. 3 dredge out of commission through August, **Bulolo Gold** Dredging Co., Ltd., handled 1,119,999 yards of gravel with the remaining six dredges for a total recovery of 6,082 oz. of fine gold valued at $35 per oz. In July, when eight dredges were operating, recovery was 7,959 oz. valued at $278,565 from 1,354,800 yds. No. 1 dredge was permanently closed down July 28 after completing the digging of the area for which it was designed. No. 3 dredge was temporarily out of commission for repairs to the digging ladder.

JAPAN

★**Mitsui Mining Co.** is reopening its gold mine at Kushikino, Kagoshima Prefecture, with the aid of 200,000,000 yen ($550,000 at the official exchange rate) loan from private banks. According to the company, an extension of a surface vein has been discovered which averages two meters in width and assays seven grams of gold per ton. Reserves in this new vein are estimated at 150,000 tons.

★**Mitsubishi Mining Co.'s** Hosokura lead-zinc mine reported an operating profit of 31,000,000 yen ($86,000) for the three month period, April through June, 1949. The mine produced 12,200 tons of crude ore averaging 1.7% lead and 5.2% zinc during July, against a previous average monthly production of 12,000 tons of ore running 2.3% lead and 5.7% zinc. Reserves are estimated at 2,000,000 tons of 2.0% lead and 6.2% zinc.

★Sado Mine of the **Mitsubishi Mining Co.** produced 7,576 tons of crude ore containing 1.4 grams of gold and 38 grams of silver per ton during July.

★In spite of SCAP's insistence, at Washington's command, that there will be no deviation from the no-subsidy program established by Joseph M. Dodge, Japanese copper producers are still trying to find some method of subsidy.

Producers want the government to buy up 10,000 tons from surplus for stockpiling at an artificial price. Dodge has agreed to government purchasing at the market price which currently is about 102,000 yen per metric ton. Producers, however, want to get 170,000 yen per ton or the price it would cost to import copper from the U. S., although Japan at present is exporting, not importing.

As an alternative, they have asked for the U. S. market price translated into yen at the current official exchange rate. This would figure out to about 140,000 yen per ton.

Failing to get this latter "compromise," copper producers will drag out a third proposal that the government pay 120,000 yen per ton, the price which they estimate Japan would get if freely exporting.

The Japanese Mining Industry Association states that if higher prices are not artificially established many producers will have to shut down. However, they also admit the big producers would get the major share of the benefits, and that these companies are now producing large quantities of electrolytic copper from scrap.

INDIA

Two of the four mines in the Kolar Gold Field, Mysore, have issued annual reports for 1948.

Mysore produced 54,629 fine ozs. of gold from 168,720 long tons of ore, an increase of 3,808 long tons in ore milled and of 5,405 fine ozs. of gold production. Thirty-four percent of the footage accomplished had pay ore averaging 2 ft. 8 ins. wide and assaying 1 oz. 10.8 dwt. per ton. Further exploration of the reef at the 43d level North, of Ribblesdale's No. 1 winze, showed excellent results. Ore reserves at the close of the year were estimated at 290,700 long tons, plus low-grade ore of 205,300 long tons.

Nundydroog produced 44,133 fine ozs., a drop of 1,989, and cost of development rose to 75 shillings a long ton. Estimated ore reserves were 240,720 long tons of an average grade of 10.33 dwt. per ton.

SOUTH AFRICA

★From Sept. 20, gold producers received 248s. 3d. (£12 8s. 3d.) an ounce for their gold, less a buying charge of 2s. per cent., compared with the old price of 172s. 6d (£8 12s. 6d.).

This new price is the result of the devaluation of the South African pound in common with sterling and other currencies.

★The most sensational development in South African gold mining circles this month was the government's announcement that it was satisfied the gold content of ore samples on which the Erfdeel E D 5 borehole result was based was fraudulently increased.

It referred to a statement handed to the press on June 3, 1949, in which it was claimed that the gold content of three samples of ore removed from the borehole in the Orange Free State had been found to amount to an equivalent of 271 dwt., 338.3 dwt. and 10,586 dwt. a ton respectively. The government had investigations made on the facts mentioned in the press statement, and although the investigation is not yet finished, it deemed it necessary in the interests of prospective investors in the Union and abroad to disclose that it was satisfied the gold content of each of the three ore samples had been fraudulently increased before it was assayed.

★The fact finding commission which investigated conditions of employment in the gold mining industry has reported to the government. It found that if the Mine Workers' Union's demands for a 30% wage increase and the other conditions were granted, it would cost the industry another £3,687,000 a year or 15.9d. more a ton milled. A 12% increase would mean an extra £1,894,000 yearly or 8.2d. per ton milled. If there were no wage increase but the improved leave and pension claims were granted the extra cost would be £614,000 or 2.7d. a ton milled.

Notwithstanding the findings of this commission, the Mine Workers' Union intends pressing for a 30% wage increase. They consider that some of the increased revenue which will come to the producers as a result of devaluation should go to them.

Proper bonding keeps power costs low . . . and MESCO rail bonds guarantee perfect bonding. MESCO bonds prevent power "leaks" and assure full conductivity at all times. 18 types meet every requirement. Write for details.

Type M8-F

Mosebach Electric & Supply Co.
1115 Arlington Avenue Pittsburgh 3, Pa.
HEmlock 8332

POWER BUG
The Portable Light Plant
. . . 110 VOLT ELECTRICITY ANYWHERE . . . ANYTIME!

Here's a completely new, lightweight, portable electric generator unit that meets all your small-power needs! This 110-volt generator with permanent-magnet rotor will run under full short circuit without harm to engine or generator.

FEATURES:

LIGHT WEIGHT . . . only 28 lbs. complete.

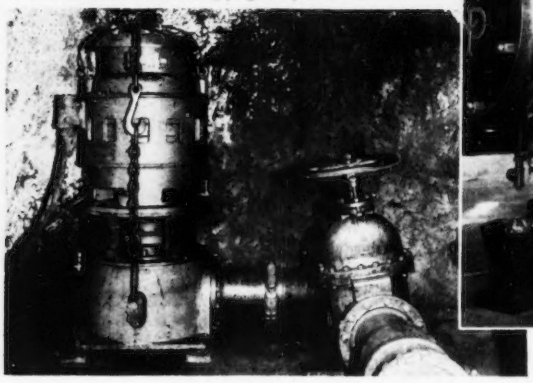
ECONOMICAL . . . Eight hrs. operation on gal. of gas means your electricity costs about 6c per kw. hr.

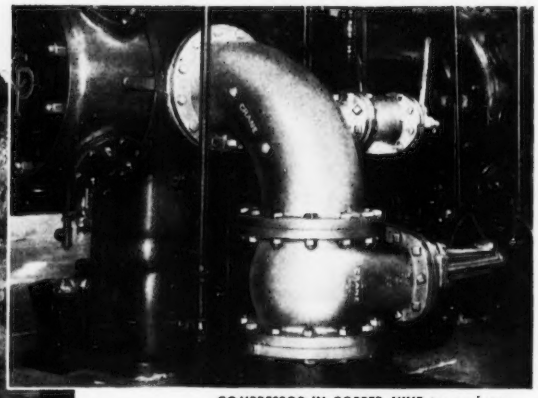
MANY-PURPOSE . . . Supplies all current needed to run lights, radio, soldering irons, etc.

The POWER BUG is an exclusive product of GICO. Write us without delay for full details and endless number of uses.

GICO 1820 N. NASH ST. ARLINGTON, VA.

IN A SILVER MINE... *Crane iron body gate valve on 10-in. line to pump suspended over open shaft. One order to Crane covers all piping items for mines.*





COMPRESSOR IN COPPER MINE *power house featuring Crane iron body double disc gate valve, and flanged fittings.*

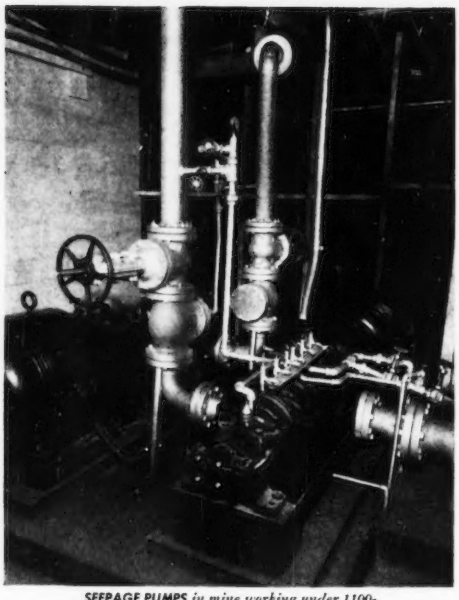
Unequaled selection of piping equipment ...on one order to CRANE

ONE SOURCE OF SUPPLY
RESPONSIBILITY
STANDARD OF QUALITY

When you need piping equipment—for power, process, or general utility lines, one order to Crane gives you better service two ways. First, you're sure to get the equipment you need because you select from the world's most complete line of valves, fittings, pipe and piping accessories. Second, no one can give you faster, more reliable service than your local, well-stocked Crane Branch or Crane Wholesaler.

Why do so many leading mine operators standardize on Crane? They know the numerous advantages to be gained . . . know that this **Single Source of Supply** is complete enough to simplify all piping procedures, from design to erection to maintenance. **One Responsibility** for materials helps to avoid delays and assures better installations. **One Standard of Quality**—Crane Quality—assures dependable performance from end to end of piping systems.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas



SEEPAGE PUMPS *in mine working under 1100-ft. head, equipped with 300-Pound Crane steel gate valves, check valves, and flanged fittings.*

EVERYTHING FROM . . .

VALVES
FITTINGS
PIPE

CRANE

PLUMBING
AND
HEATING

FOR EVERY PIPING SYSTEM

Truco bits are used throughout the world *because*

★ they hold gauge longer

★ they cut faster

★ they are exceptionally tough and absorb punishment

★ they give greater salvage

★ they are availble in SOFT, MEDIUM or HARD matrix to provide highest efficiency in any formation

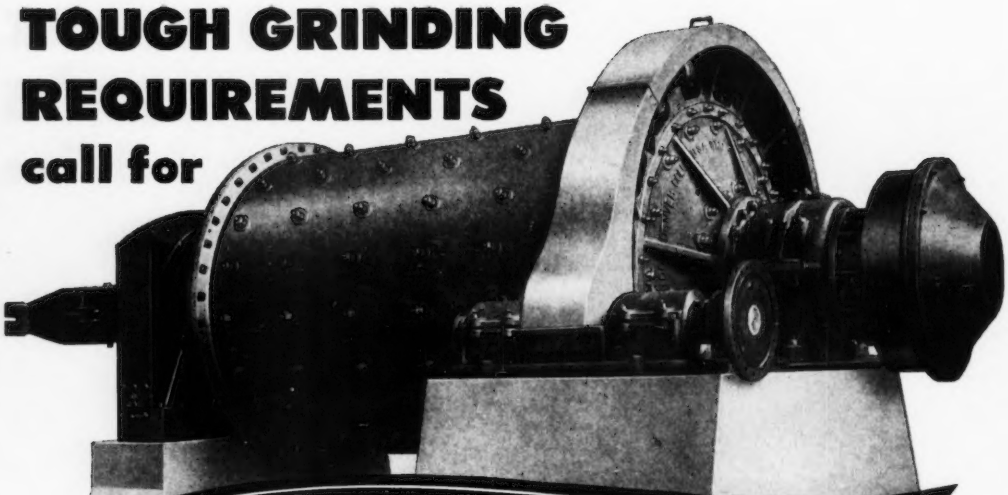
★ they are backed by a speedy resetting service.

Write for information and prices.

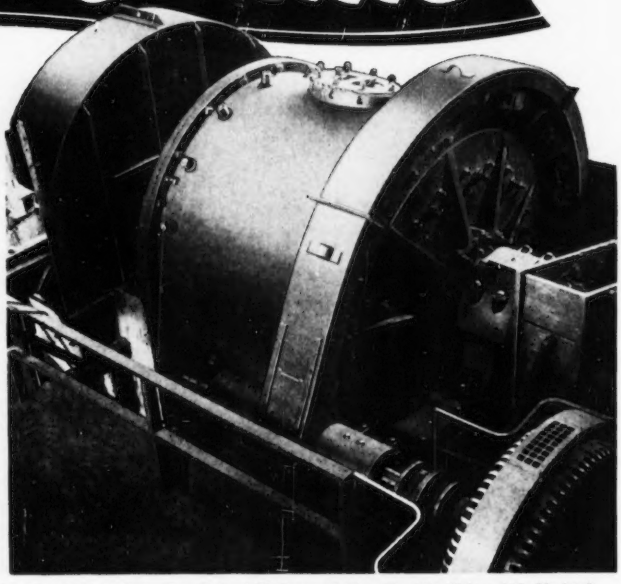
WHEEL TRUEING TOOL COMPANY
3200 W. Davison Avenue
Detroit 6 • Michigan

WHEEL TRUEING TOOL CO. of CANADA, LTD.
575 Langlois Avenue
Windsor, Ont. • Canada

TOUGH GRINDING REQUIREMENTS call for



Marcy Mills



Leading ore milling plants set tough requirements; they have to. Over many years they have specified Marcy Mills as the answer to uniform grinding at lower cost. The record of reorders from all parts of the world shows Marcy Mills are able to deliver against all comers.

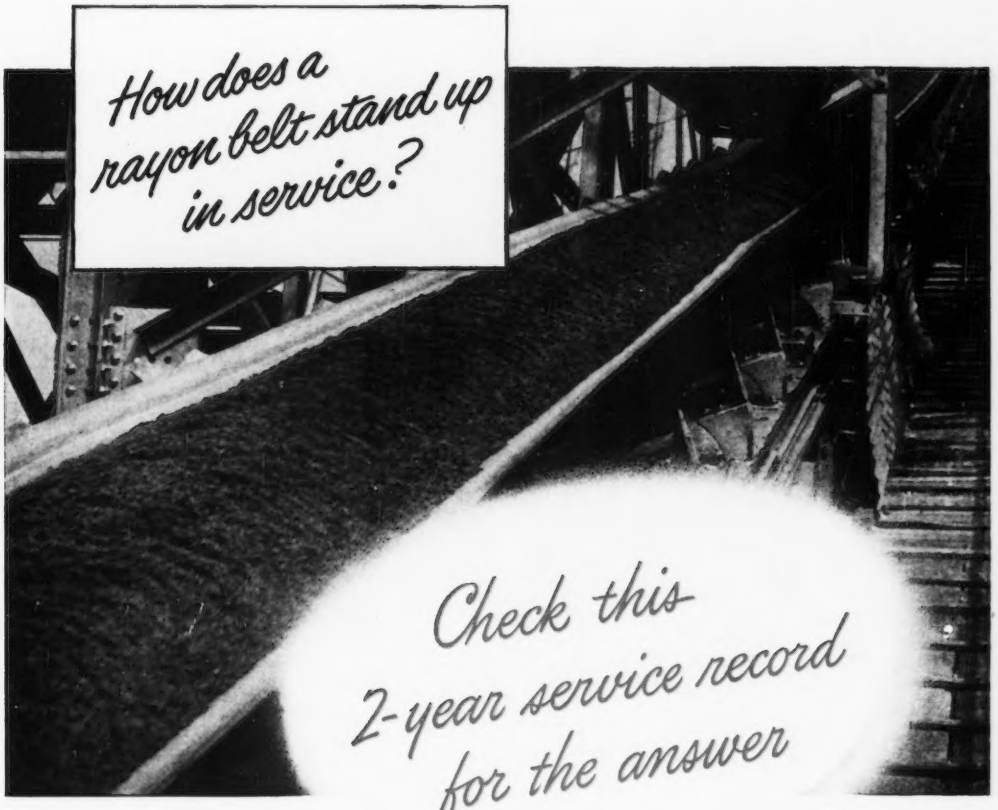
Open end grate discharge provides quicker removal of the finished product without wasteful overgrinding. Marcy Design provides many times as much discharge opening as conventional trunnion overflow mills. Cushioning is less, impact drop is greater, pulp density much higher. Finished material discharges automatically when finished. These gains add up to more tonnage, lower per ton costs, and improved metallurgy throughout the flowsheet.

Marcy Ball and Rod Mills are built in types and sizes to meet every ore milling requirement. "Mine and Smelter's" metallurgical experience is at your service. Your inquiry will be given immediate, competent attention.

Main Office: DENVER, COLO., U.S.A.: El Paso; Salt Lake City; 1775 Broadway, New York, N.Y. Representatives: Canadian Vickers, Ltd., Montreal; W. R. Judson, Santiago and Lima; The Edward J. Nell Co., Manila, P. I.; The Ore & Chemical Co., 80 Broad St., New York 4, N. Y., for Continental Europe.

Massco Fahrenwald Flotation Machines; Genuine Wilfley Tables; Massco-McCarthy Hot Millers; Rock Bit Grinders; Density Controllers; Belt Feeders; Pinch Valves; Assay and Laboratory Supplies and Equipment; Complete Milling Plants; Constam Ski Lifts.

The Mine & Smelter Supply Co.



There's nothing theoretical about the performance of this conveyor belt, made with Du Pont Cordura* High Tenacity Rayon. This 4-ply belt does just what designers figured it would do when it was installed two years ago to replace a 6-ply belt.

Users say it's the kind of belt you just don't notice! Day in, day out it does a satisfactory job in a typical outdoor installation. It's been covered with snow and ice through two severe winters . . . frozen to the pulleys . . . always wet, carrying damp sand and gravel.

The extra strength of "Cordura" Rayon shows up in the fact that the belt has stretched very little. After the first month's service, the operators took it up 25". It has now completed two years of service without splicing.

This installation is an example of how "Cordura" packs strength into a conveyor belt. This belt is only about one-half as thick as the one it replaced—and 50% stronger!

For improved conveyor belt performance, get the facts on Du Pont "Cordura" Rayon. Ask your supplier. Or write Room 4529, Rayon Division, E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Delaware.

*REG. U. S. PAT. OFF.

Look to "Cordura" Rayon for these conveyor belt advantages

- ★ Greater tensile strength
- ★ Longer life
- ★ Heavier loads
- ★ Improved troughability
- ★ Longer lifts with fewer transfer points
- ★ Lighter belts that are easier to set up
- ★ Resistance to flexing
- ★ Resistance to loading impacts
- ★ Reduced operating power expense

DU PONT "CORDURA" HIGH TENACITY RAYON

DU PONT

REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

for RAYON . . . for NYLON . . . for FIBERS to come . . . look to DU PONT

COMPLETE SERVICE

CHRISTENSEN

Diamond Bits
Supplies and Machines For
The Drilling Industry

Christensen Diamond Core Bits provide the industry with uniformly high quality, dependable service for every need. Christensen designs and produces diamond core bits, concave bits, pilot bits, casing shoes, casing bits and reaming shells.

The same fidelity of design, engineering and manufacture that characterizes Christensen bits goes into the production of drill rod, core barrels and a complete supply line for the driller.

Christensen surface drills, either hydraulic or screw feed, gasoline or air powered. Skid mounted for easy moving. Capacities up to 2000 feet of hole. Underground air drills for exploratory, blast hole and all underground drilling needs. Capacities up to 1000 feet of hole.

Compact • Sturdy • Efficient

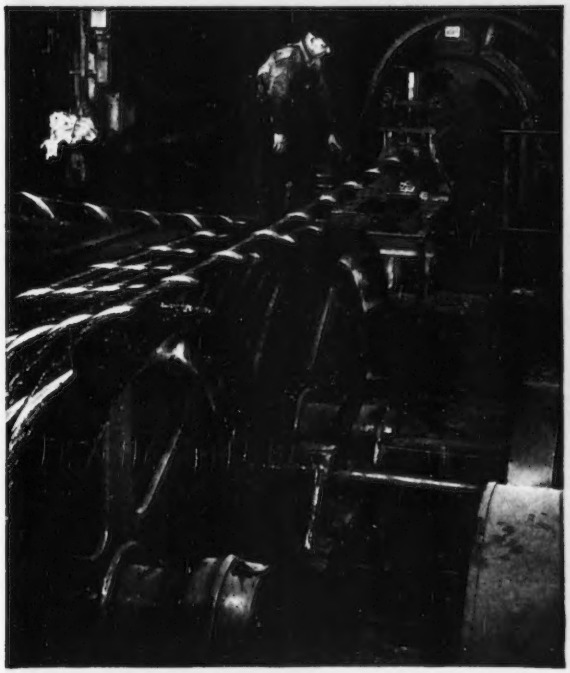
LESS COST PER FOOT
CHRISTENSEN
DIAMOND PRODUCTS

Less Cost Per Foot

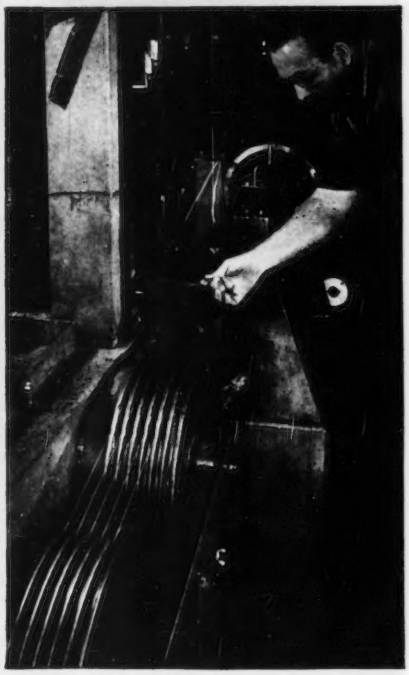
CHRISTENSEN DIAMOND PRODUCTS COMPANY

1975 SOUTH 2ND WEST • PHONE 6-8738 • SALT LAKE CITY, UTAH

This photograph shows a 3⅛" diameter Monarch Whyte Strand Wire Rope coming off a Macwhyte closing machine. Weight of this rope is approximately 16.65 pounds per foot. It has a strength of approximately 392 tons and is used for the digging line on large dragline excavator with 35 cu. yd. bucket.



In this photograph is a 3/64" diameter Stainless Steel Cord coming off a Macwhyte closing machine. It weighs approximately 0.35 lbs. per 100 feet; has a strength of approximately 270 pounds, and is used for many small cord needs.



Whether you need

LARGE WIRE ROPE or SMALL WIRE CORD

make your selection from

You will get smoother operation and better service when you use the wire rope designed and manufactured to meet your requirements.

Macwhyte engineers are always glad to suggest the correct Macwhyte rope or cord best suited to your needs.

Just drop a card or letter to Macwhyte Company or your Macwhyte distributor.

a thousand and one
WIRE ROPES
made by
MACWHYTE

MACWHYTE COMPANY

2937 Fourteenth Avenue **Kenosha, Wisconsin**

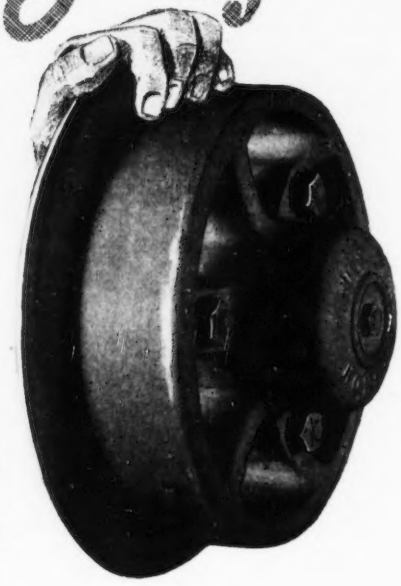
Manufacturers of Monarch Whyte Strand PREformed, Internally Lubricated Wire Rope, Atlas Braided Wire Rope Slings, Aircraft Cables and Assemblies, Monel Metal and Stainless Steel Wire Rope.

Mill Depots: New York • Pittsburgh • Chicago
Minneapolis • Fort Worth • Portland • Seattle
San Francisco • Los Angeles

Catalog on request.

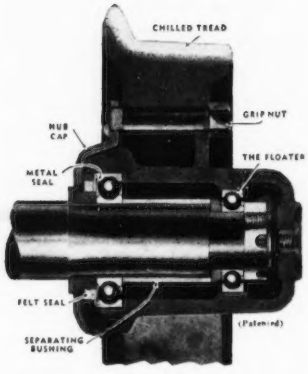
our "FLOATER" wheels save us money in...

4 Big Ways!



MINE OPERATORS tell us that the S-D "Floater" Demountable Ball Bearing Wheels save them money in FOUR Big Ways!

1. **Lubrication Costs—Slashed! Greasing costs that once piled up gradually month-by-month are now held in check at a minimum. With solid closed front hubs and double rear seals there is no grease leakage. We have numerous reports that wheels have not been greased in five or more years.**
2. **Power Costs — Slashed! Operators report — and tests by independent engineering firms have proved —that smooth-running "Floaters" increase the net loads hauled by locomotives as much as 50% over other types of precision bearings . . . a tremendous power saver.**
3. **Labor Costs—Slashed! When it is necessary to remove a wheel operators find that the "Floater" can be demounted as quickly and easily as an automobile wheel, and with unskilled men. No adjustment of bearings to worry with, therefore no loose, tight or pinched bearings . . . a big time saver.**
4. **Repair Costs—Slashed! S-D "Floater" wheels have become famous because of their toughness and long wear. Our own special mixture of iron and exclusive Heat Treatment are responsible for this reputation. Such quality is your assurance of perfect satisfaction.**



20 Car loads of "Automatics" from—

SANFORD-DAY IRON WORKS, Inc. Knoxville 9, Tenn.

A NEW ALL STAR CAST

THE NEW TD-24

The new TD-24 offers you more horsepower than any other crawler tractor available today—180 hp. at the flywheel, 140 hp. at the drawbar—plus dozens of features found only in the new TD-24.

THE NEW TD-14A

The new TD-14A has 60 drawbar horsepower and many mechanical improvements. Here is additional power to produce big payloads and cut your operating costs.

THE NEW TD-18A

Famous for its power and dependability, the new TD-18A now gives you 87 drawbar horsepower. All the famous International diesel engine features plus the durable construction of this new International TD-18A make this tractor an even greater payload producer than ever before.

Your International Industrial Power Distributor is now ready to furnish you these three great new stars of mining power and payload production—the new TD-24, the new TD-18A and the new TD-14A.

The great new TD-24 is America's most powerful and versatile crawler tractor with unmatched features for easier operation and far greater work capacity. No other crawler tractor can give you all the features found in the new International TD-24.

And the other two stars on the new International power-packed team are the TD-18A and TD-14A. Known for years for their dependable performance, these two efficient tractors have had their power increased to do more work, to operate with even greater ease and economy than before.

See your International Industrial Power Distributor now. Find out the facts and get these new tractors to work for you. You'll have an all-star cast on your strip or open pit mining line-up.

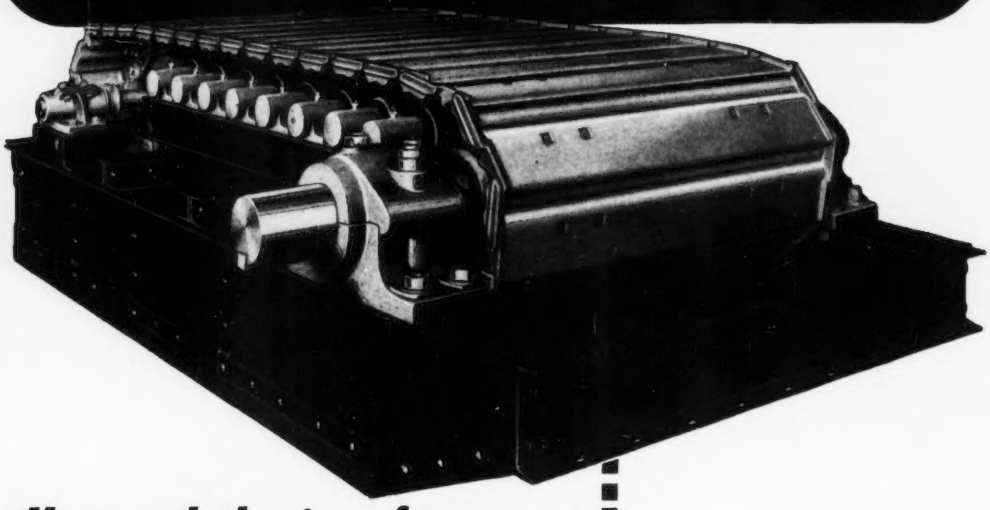
INTERNATIONAL HARVESTER COMPANY, Chicago, Ill.

CRAWLER TRACTORS
WHEEL TRACTORS
DIESEL ENGINES
POWER UNITS

INTERNATIONAL HARVESTER

INTERNATIONAL INDUSTRIAL POWER

LINK-BELT Heavy-Duty Apron Feeders



Unusual design features cut ore feeding costs

Link-Belt heavy-duty apron feeders have a number of exclusive features that increase durability and cut costs.

The heavy-duty design shown above is used for handling minerals containing lumps in size from ¼ inch and smaller up to 6 feet.

Sprockets, chains, rollers and overlapping (non-sagging) apron pans are made of manganese or cast steel. The chains on the loaded run are adequately supported on rugged rollers which are independently mounted on heavy shafts turning in closed end bearings. These rollers are located under the apron in protective positions and eliminate exposure to destructive materials.

For detailed description and range of sizes, write for Folder No. 1551 or get in touch with our nearest office.

LINK-BELT

CONVEYORS, MATERIALS HANDLING, PREPARATION AND POWER TRANSMISSION MACHINERY

Other LINK-BELT types of feeders and conveyors

Link-Belt builds apron feeders and conveyors in a range of sizes and a variety of types to suit numerous applications.

11,295

LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices in Principal Cities.

Every bucketful means wear!

Each bite in old mother earth takes metal off your shovel components. Every load dumped reduces wall thickness and shortens bucket life. Good maintenance means good hard-facing. STOODY ALLOYS give you *most* protection for least expenditure.

Remember, there's a Stoody Alloy for every abrasive wear problem. Ask your dealer for recommendations or write direct. We're glad to help.

For best all-around shovel protection we recommend Stoody Self-Hardening **21**. Besides possessing good impact strength, its high alloy content insures excellent abrasion resistance. These features coupled with low price give most protection per dollar. Try Stoody Self-Hardening **21** today

STOODY COMPANY

11940 EAST SLAUSON AVENUE, WHITTIER, CALIFORNIA

Often worth its weight in Gold!

When production groans to a halt because of broken or fractured equipment, many shop-owners would gladly pay the price of gold for the few ounces of bronze needed for a reliable repair-weld.

They don't have to, of course. For repair-welding with Anaconda Bronze Rods—particularly Tobin Bronze*—is a low-cost, low-temperature method of oxyacetylene welding on cast or malleable iron, steel or copper alloys.

Over the decades that time-tried Tobin Bronze has served so well, many "new" rods and procedures have sprung up with mushroom-like growth, only to disappear as quickly—victims of their own lack of dependability!

Whether you do your own repair welding or call on outside help, play it safe—insist on genuine Tobin Bronze.

49152

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut
Subsidiary of Anaconda Copper Mining Company
In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

*Reg. U. S. Pat. Off.

DON'T SCRAP IT . . . BRONZE WELD IT!

Bronze welding is safe, speedy and economical. Large or small, bronze welds are tough and readily machinable, high in strength and low in residual stresses—an ideal combination for repair welding, for building up worn surfaces, and for production welding, too. Tobin Bronze and other Anaconda Welding Rods are described in this NEW, 17th Edition of Publication B-13. Write for a copy.

ANACONDA
from mine to consumer

Anaconda
BRONZE WELDING RODS

Crammed with outstanding features of safe and efficient operation! Air Bar Feed converts hand-feed Drifters—yes, and Sinkers too!—to fast efficient POWER FEED! Six speeds forward and reverse!

Fool proof Pneumatic Column simplifies drifting set-up. Built to stand up longer under severe use than anything in its class today!

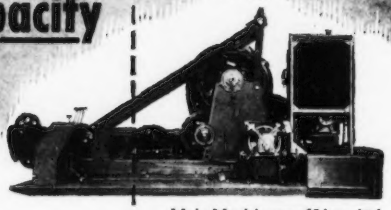
Illustrated circular No. JE1132 tells complete story of these and other new cost-saving Thor air operated mining tools. Send for it today!

The new Thor Pneumatic Column and Air Bar Feed have been tested and approved at leading mines! Order one or both in on trial today. Prove by your own tests that never before have such tremendous savings been made available to operators of large and small mine drifting operations! Independent Pneumatic Tool Co., Aurora, Illinois

Thor PORTABLE POWER TOOLS

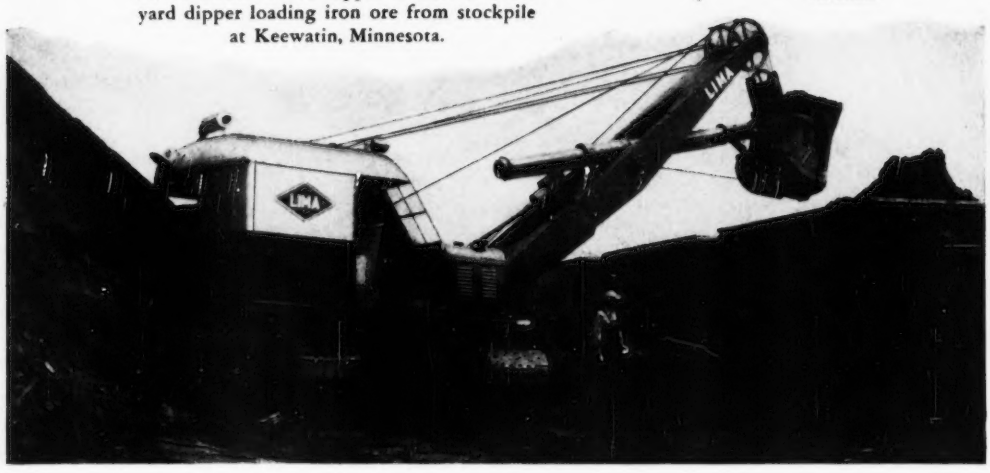
ELECTRIC • PNEUMATIC

Why the LIMA Type 604 develops the greatest capacity per lb. of weight



Main Machinery of Lima 604. Dotted line shows center of rotation.

Lima Type 604 Shovel equipped with 23 ft. boom, 18 ft. dipper handle and 1½ yard dipper loading iron ore from stockpile at Keewatin, Minnesota.



● The LIMA Type 604 shovel, crane and dragline is engineered to produce greatest capacity with minimum weight. This is achieved by placing as much weight as possible *behind* the center of rotation—eliminating the need for excessive counterweight. Hook rollers on which the machinery base revolves eliminate strain from the center pintle—permitting continuous, safe operation at full capacity.

The simple, compact design of the main machinery, using the fewest number of shafts to accomplish the various operations, further contributes to efficient, trouble-free service.

These are only a few of the features which make the LIMA 604 a favorite with owners and operators. The Lima Line includes shovels ¾ to 6 yards, Cranes 13 to 110 tons and Draglines variable.

It will pay you to consult your nearest Lima Sales Office or representative before you buy your next shovel, crane or dragline. Offices in principal U.S. cities.

Lima Shovel and Crane Division

LIMA, OHIO

LIMA HAMILTON CORPORATION

OTHER DIVISIONS: *Lima Locomotive Works Division; Niles Tool Works Co.; Hooven, Owens, Rentschler Co.*

BWH
DEPENDABLE RUGGEDNESS
BOSTON WOVEN HOSE & RUBBER CO.
CONCORD
BWH
1. NEW oil, grease and sun-resistant cover. Long wearing, tough, abrasion resistant.
2. Asbestos braid insures maximum cover adhesion, includes new type static-conducting wire.
3. High-tensile steel wire for strength and safety.
4. Heat & oil-resistant tube.

NEW BWH COVER DEFIES "RUBBER EATERS"

RESISTS OIL, GREASE, SUN AND ABRASION DAMAGE

Oil, grease, strong sunlight and abrasion are factors that can't be controlled in many industrial operations. Yet they are all "rubber eaters" that tend to break down covers on steam hose and to shorten its service.

BWH technologists sweated over the problem for many laboratory hours before they developed this new, die-hard, synthetic rubber cover for Concord #10 Steam Hose. This improved cover adds so much to steam hose life, nobody with an eye to operating expenses can afford to overlook it. Yet it costs no more than ordinary hose!

Here's what makes Concord #10 a good choice for hard jobs:

1. It has the same dependably strong heat- and oil-resistant tube that won fame for extra service in BWH Bull Dog Steam Hose.

2. It is fortified with braids of high-tensile steel wire which are heat and pressure resistant. Gives strength with extreme flexibility.

3. Asbestos braid assures perfect cover adhesion, includes new type static-conducting wire.

4. NEW cover is unharmed over longer periods by oil, grease and sunlight—resists abrasion and highest steam temperatures.

When you need EXTRA safe hose that prevents "burst" explosions, withstands working pressure to 200 lbs. and gives you more for your money, investigate Concord #10 with new abuse-resistant cover!

HAVE YOU A JOB WHERE STAMINA COUNTS?

Bring us your toughest problems... we're specialists in solving them. Consult your nearby BWH distributor or write us.

Another Quality Product of

BOSTON WOVEN HOSE & RUBBER COMPANY

Distributors in all Principal Cities

PLANT: CAMBRIDGE, MASS., U.S.A. • P.O. BOX 1071, BOSTON 3, MASS.

THE 3/4-YARD LORAIN IS HERE...

Thew TL 25 Lorain

IT'S BIGGER...HEAVIER!

GREATER CRANE CAPACITIES!

IT'S FIELD TESTED!

EXTRA-LONG OR WIDE GAUGE CRAWLERS AVAILABLE!

IT'S THE BEST BUY IN 3/4-YD. SHOVEL-CRANES!

• Users asked for it! Here it is! Now, a big-producing ¾-yd. Lorain TL-25 that gives you more of everything for your money! More output—with the big-producing ¾-yd. dipper! More weight—and greater crane capacities. This new addition to the Lorain line brings you the most modern machine of its class...with more features for high production and long life. Here are 16 *plus* values in the new Lorain TL-25... (1) INTERCHANGEABLE MAJOR COMPONENTS (2) 5 IDENTICAL SHOE CLUTCHES (3) ANTI-FRICTION BEARINGS (4) OIL-ENCLOSED CUT GEARS (5) INTERCHANGEABLE PARTS (6) A ONE-PIECE TURNTABLE BED (7) HOOK ROLLERS (8) STANDARD AND WIDE GAUGE CRAWLERS (9) EXTRA-LONG CRAWLERS FOR DRAGLINES (10) TWO CRAWLER SPEEDS (11) DROP FORGED TREADS (12) POSITIVE TRAVEL LOCK (13) "FULL CIRCLE" STEERING (14) POSITIVE INDEPENDENT SHOVEL CROWD (15) ALL-PURPOSE CRANE BOOM (16) GOOSENECK HOE BOOM.

MORE FOR YOUR $ IN A LORAIN

Plan now to equip your next job with the stand-out ¾-yd. Lorain TL-25...Your nearby Thew-Lorain Distributor will give you all the details!

THE THEW SHOVEL CO., LORAIN, OHIO

A NEW ½-YD. LORAIN

Thew TL 15 Lorain

For The Smaller Jobs

The new TL-15 rounds out the "TL" series. It's a lighter ½-yd. version of the TL-25—with shorter tail swing and narrower crawler mounting—yet gives you the outstanding plus values of the TL-25. Here's the best ½-yd. buy for your money.

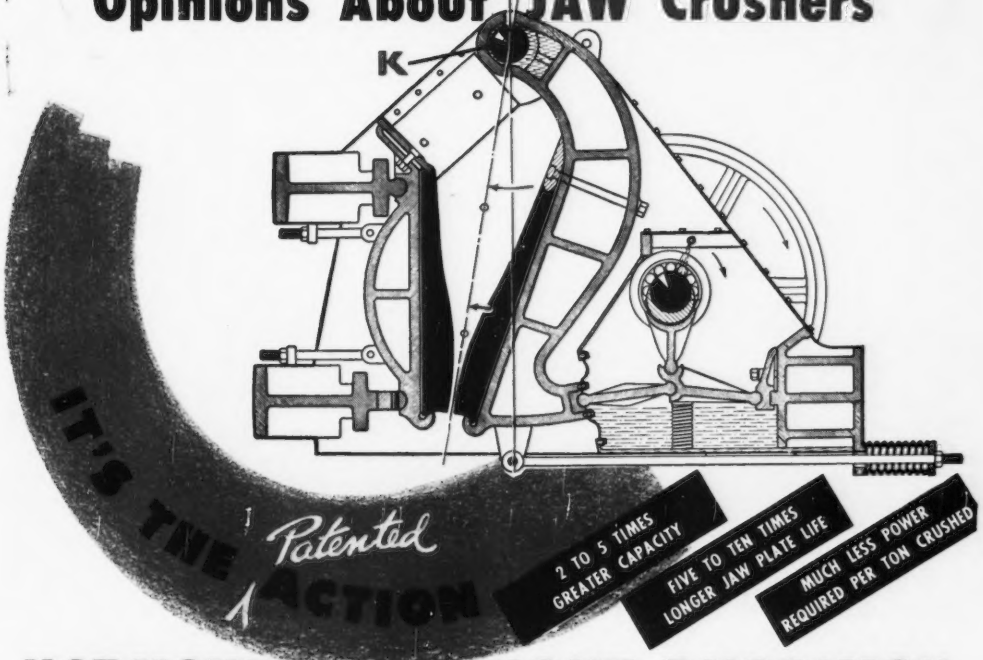
Get the New Lorain TL-25 and TL-15 story from your Thew-Lorain Distributor.

THEW · Lorain ®

Thew TL 25 Lorain

SHOVELS · CRANES
DRAGLINES · HOES
CLAMSHELLS

The *New* KUE-KEN *is* Changing Opinions About JAW Crushers


K
IT'S THE Patented ACTION
2 TO 5 TIMES GREATER CAPACITY
FIVE TO TEN TIMES LONGER JAW PLATE LIFE
MUCH LESS POWER REQUIRED PER TON CRUSHED

"CRUSHING WITHOUT RUBBING"

Blake or Double Toggle Crusher
(Designed 1858)

Note how swing jaw forces rock upward causing rock to rub against jaws (see arrows). This rubbing action rapidly wears jaw faces, increases the percentage of fines, and reduces capacity of the crusher.

Dalton Overhead Eccentric or Single Toggle Crusher
(Designed 1879)

Moving jaw forces rock both up and down (see arrows), causing a rubbing action that not only results in excessive fines, but causes heavy jaw plate wear and wasted power. Bearing pressures on this type are very high.

Until the new Kue-Ken came on the market, most operators (and engineers) held an understandably low opinion of jaw crusher efficiency. The old double toggle and overhead eccentric types (left) were heavy, slow speed, unbalanced, poorly lubricated machines that crushed with a rubbing motion between the jaws, resulting in rapid jaw plate deterioration, excessive fines, power waste, and low capacity.

Kue-Ken design has changed all this, because the Kue-Ken crushes by *pressure only*. With its hinge pin (K) located on the crushing zone center line, the Kue-Ken's massive swing jaw moves *squarely* against the rock (or other material), instantly gripping and crushing—without forcing rock upward; without rubbing. Result: greater capacity, longer jaw plate life, fewer fines, and less power demand.

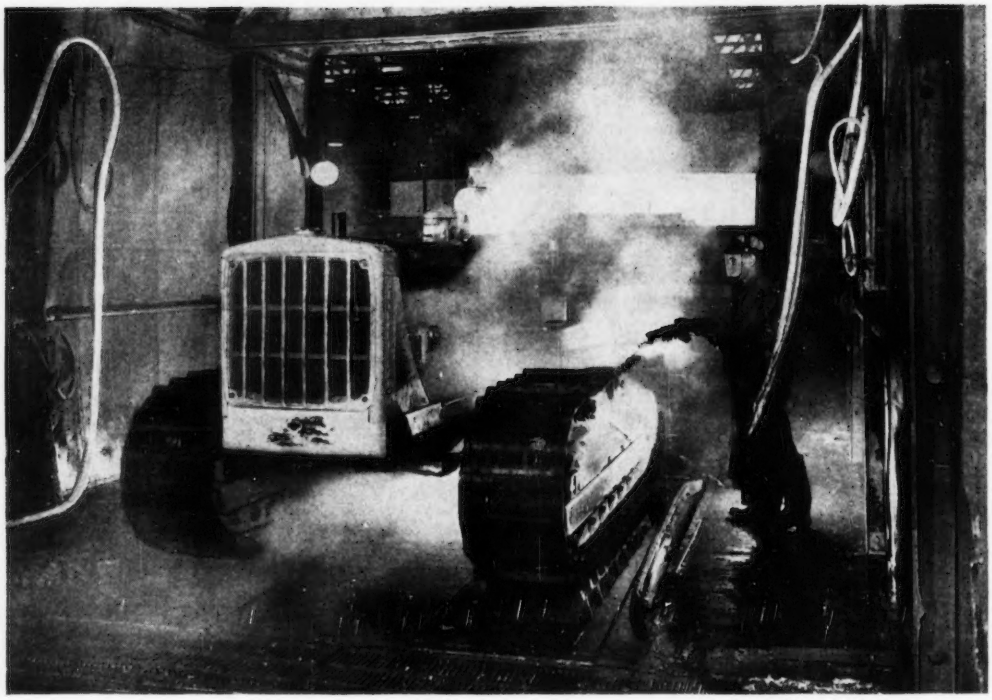
A Texas plant reports that its Kue-Ken Jaw has crushed 225,000 cu. yds. of hard, wet river gravel during a 4 year period. No parts or replacement costs or out-of-service from breakdowns; only *minor service adjustments*. Don't turn down a Jaw for the job until you've investigated the Kue-Ken, the *improved* jaw crusher. Send for Bulletin 5012.

Exclusive Eastern Manufacturer and Distributor

PENNSYLVANIA CRUSHER COMPANY
A DIVISION OF BATH IRON WORKS CORPORATION

Liberty Trust Building, Philadelphia 7, Pa.
New York • Boston • Pittsburgh • Birmingham • Roanoke • Detroit • Chicago • St. Louis • Crosby, Minn. • Los Angeles— Associated with Fraser & Chalmers Engineering Works, London

Manufacturers of • Hammermills • Single Rolls • Bradmills • Kue-Ken Jaws • Kue-Ken Gyracones • Granulators • Impactors • Bradford Breakers



Courtesy of Caterpillar Tractor Co.

Republic Steams "Caterpillar" Diesels

. . . Republic Hose is used in every industry

Tough "Caterpillar" Diesel Tractors are perfectly groomed.

Each one is blasted by steam before the final protective paint dresses them up and protects their hides. Republic's Steam Hose is used for this cleaning job, and Caterpillar Tractor Co. has found Republic Rubber's E-101 Steam Hose to be highly satisfactory in maintaining the production schedule of its products.

"I am not surprised," says Mr. John H. Flora, president of Hagerty Brothers Company, the Republic Distributor in Peoria, Illinois. He knows that Republic Rubber Products are built ruggedly, and it just seems natural to him that these tough tractors should be serviced by Republic's sturdy E-101 Hose.

The body of Republic Steam Hose is constructed with plies of strong, insulated hard-woven duck which is applied on a bias for maximum pressure resistance and flexibility. The thick heat-resisting tube retains its flexibility under severest conditions. A tough, abrasion-resistant cover protects the hose from service wear and unusual punishment.

Republic, 47 years experienced, serves all industries and is qualified to aid *you* in any problem concerning Mechanical Rubber Goods.

Look in the classified section of your telephone directory for your local Republic Distributor's name, or write direct.

Mr. John H. Flora, Pres. & Treas. Hagerty Brothers Company Peoria, Illinois

★

Pioneers in the use of COLD RUBBER

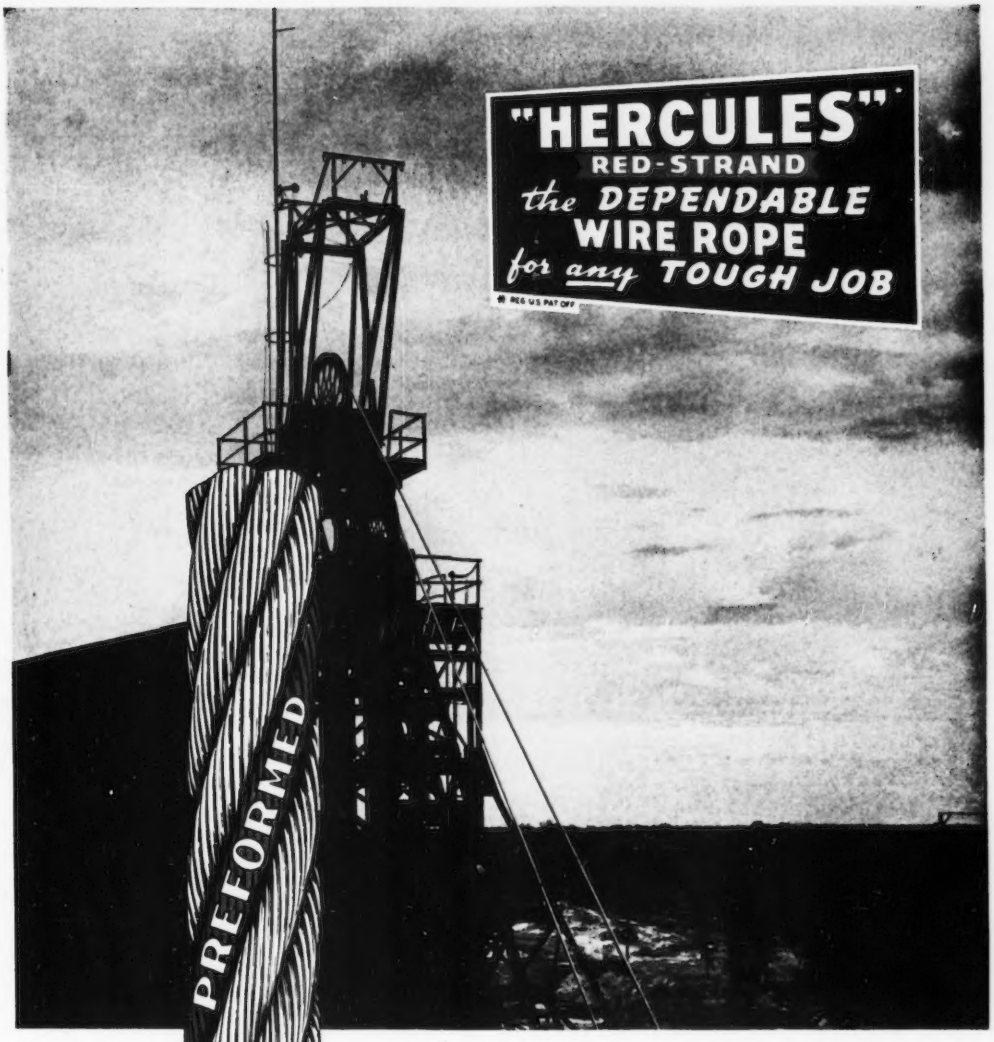
REPUBLIC RUBBER DIVISION

LEE RUBBER & TIRE CORPORATION, YOUNGSTOWN, OHIO

Lee Deluxe Tires & Tubes · · Conshohocken, Pa.

MECHANICAL RUBBER GOODS BY

REPUBLIC RUBBER DIVISION



Our Engineering Department will gladly help you select the right construction of Preformed "HERCULES" (Red-Strand) Wire Rope for your particular equipment.

. . . As a measure of value, nothing can take the place of PERFORMANCE . . . By the use of this accurate yardstick — year after year and under extremely severe working conditions of all kinds — Preformed "HERCULES" (Red Strand) has become recognized as "the Dependable Wire Rope for Any Tough Job". For over 60 years the "Red-Strand" has been a reliable guide to safe and economical wire rope service.

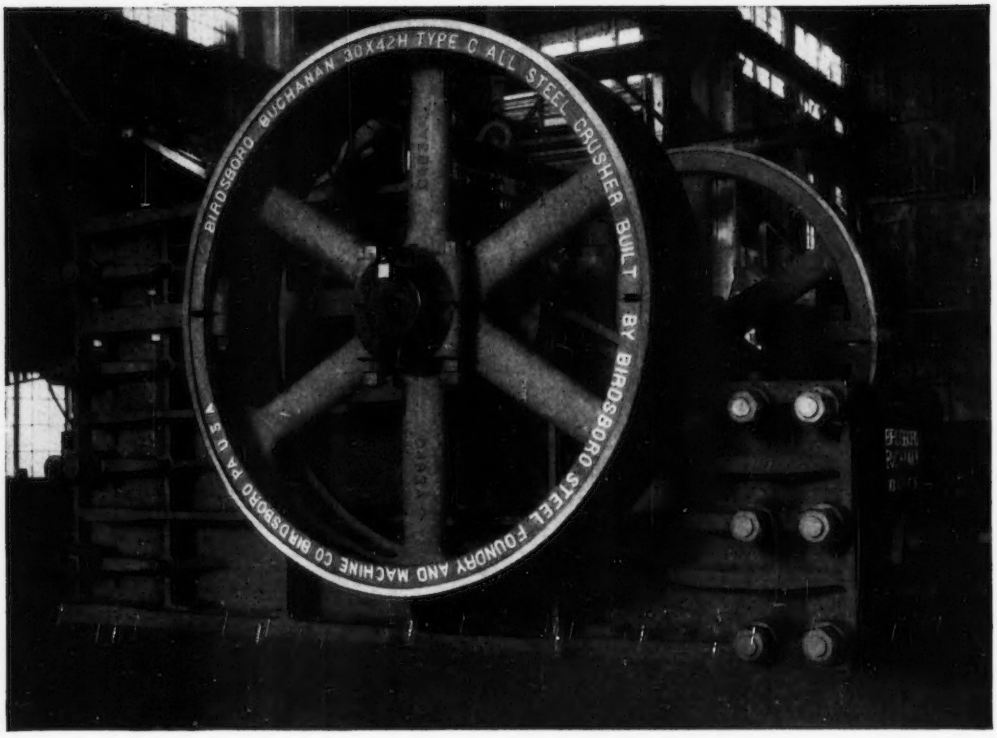
MADE ONLY BY

A. LESCHEN & SONS ROPE CO.

ESTABLISHED 1857

5909 KENNERLY AVENUE • ST. LOUIS 12, MISSOURI

NEW YORK 6 • CHICAGO 7 • BIRMINGHAM 6 • HOUSTON 3 • DENVER 2
LOS ANGELES 21 • SAN FRANCISCO 7 • PORTLAND 9 • SEATTLE 4



Keep up with the latest crusher developments . . . Send for this Type C Crusher Catalog on your company letterhead without delay . . . And if you have a special crushing problem, call in a Birdsboro engineer.

BIRDSBORO-BUCHANAN CRUSHERS

Built to Cut CRUSHING COSTS

with Dependable, Trouble-Free Operation

Birdsboro-Buchanan Crushers, in day-in and day-out service on hundreds of mining and quarrying operations, have proved their efficiency in the fast reduction of all types of rock and ore while providing substantial power savings and reducing maintenance costs.

These units are simple in design and ruggedly built with deep, strong all cast steel frames—and jaw openings from 24" x 36" to 66" x 84" to handle all primary crushing assignments.

BIRDSBORO STEEL FOUNDRY & MACHINE COMPANY - BIRDSBORO, PA.

DESIGNERS AND BUILDERS OF:
Crushing Machinery - Rolls - Steel Mill Equipment - Hydraulic Presses - Special Machinery - Steel Castings

World Wide Agent Representation
Contact home office for nearest representative

Canadian Representative & Manufacturer
JOHN INGLIS CO. LTD.,
TORONTO, CANADA

BIRDSBORO
BUCHANAN JAW CRUSHERS

Cost Conscious?

If you're interested in getting more work out of your equipment on less low-cost fuel, with less upkeep, over more profit-making hours . . .

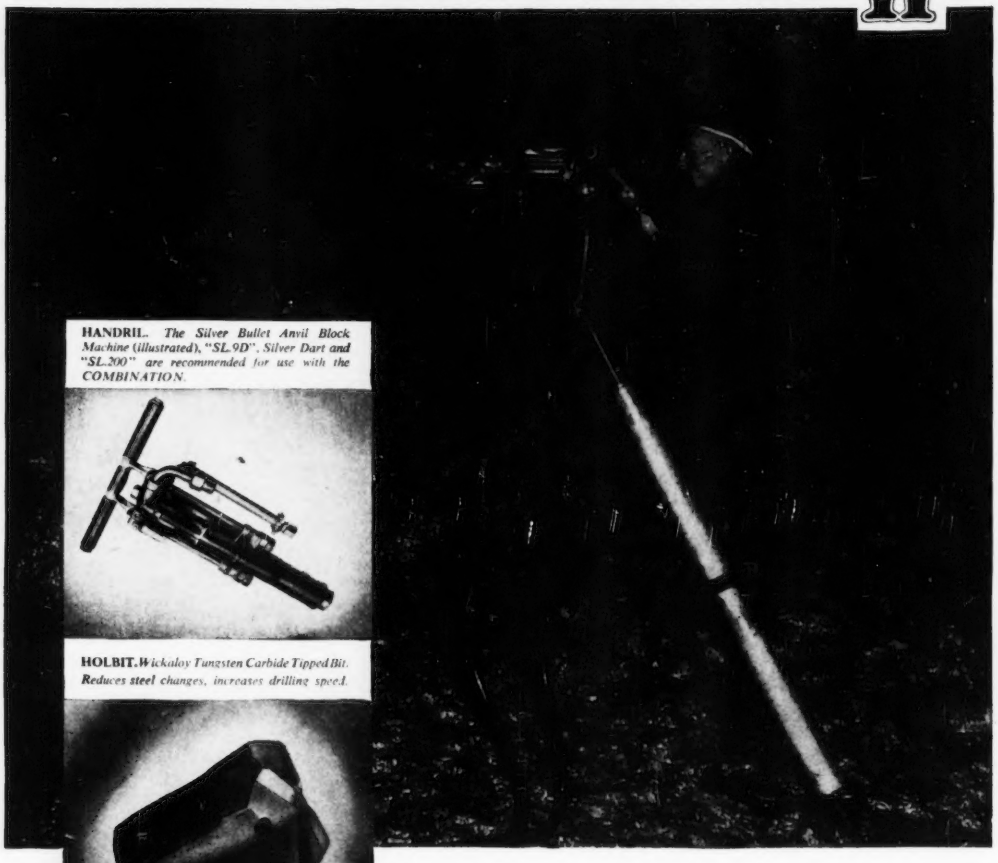
Choose Cummins Diesels

P.S. Your Cummins Dealer can show you proof. Call him today!

CUMMINS ENGINE COMPANY, INC. · COLUMBUS, INDIANA

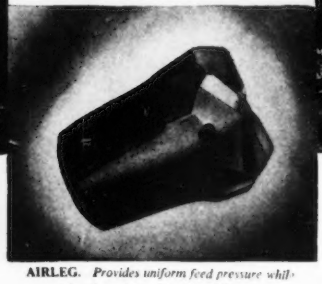
EXPORT: CUMMINS DIESEL EXPORT CORPORATION · COLUMBUS, INDIANA, U. S. A. · CABLE: CUMDIEX

Handril - Airleg - Holbit - the Versatile Holman Combination



HANDRIL. *The Silver Bullet Anvil Block Machine (illustrated), "SL.9D", Silver Dart and "SL.200" are recommended for use with the COMBINATION.*

HOLBIT. *Wickaloy Tungsten Carbide Tipped Bit. Reduces steel changes, increases drilling speed.*



AIRLEG. *Provides uniform feed pressure while supporting the weight of the Handril.*

In mines throughout the world the HOLMAN COMBINATION is saving labour and increasing output. It will drill holes in any position and at any angle in a face, it demands very little effort from the operator. In a few minutes it will drill a deep parallel hole with a steady forward movement and without needing a steel change, and it can instantly be reset for the next hole. Full particulars of this great advance in drilling technique will be sent on request.

Holman BROS. LTD.
CAMBORNE, ENGLAND
TELEPHONE: CAMBORNE 2275 (7 LINES)
TELEGRAMS: AIRDRILL, CAMBORNE
SUBSIDIARY COMPANIES, BRANCHES AND AGENCIES THROUGHOUT THE WORLD

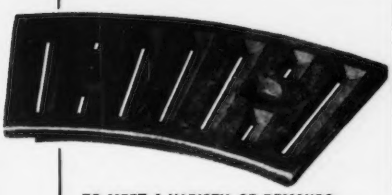
The first name for lasting service

where use means abuse

. . . specify NICKEL ALLOY STEEL CASTINGS

CAST ROLL SHELLS OF THIS STEEL OFTEN INTERCHANGED WITH THOSE OF FORGED STEEL

Ore crusher roll shells cast in "Dofasco" steel . . . containing 2.00 to 3.00% nickel, 0.9 to 1.10% chromium and 0.30 to 0.40% molybdenum . . . are widely used in Canada, often interchangeably with those of forged steel. This steel is a product of Dominion Foundries & Steel, Ltd., Hamilton, Ont.



TO MEET A VARIETY OF DEMANDS

Taylor-Wharton's "Alloy No. 80" is utilized in castings such as this cement mill outlet grate, and for other applications where parts may be used rough-cast. They can be finished-machined where dimensional accuracy is required.

TO OBTAIN HIGH ABRASION-RESISTANCE

these sand pump parts were cast by the Taylor-Wharton Iron & Steel Company, High Bridge, N. J., in its "Alloy No. 80" containing on an average, 0.45% carbon, 2.00% nickel, 1.50% chromium and 0.35% molybdenum —

Hardness may be varied from 300 to 600 Brinell, depending on the toughness required in addition to abrasion-resistance.

Advantages

of Alloyed Over Plain Carbon Steel Castings

1. STRONGER...HIGHER YIELD STRENGTH
2. LESS BULK and DEADWEIGHT
3. HARDER...MORE WEAR RESISTANT
4. BETTER RESPONSE TO HEAT TREATMENT
5. GREATER SHOCK-RESISTANCE
6. GREATER FATIGUE STRENGTH
7. LESS EMBRITTLEMENT AT SUB-ZERO TEMPERATURES

Here are castings that provide high mechanical properties without excessive weight.

Safely and economically . . . cast nickel alloy steels with high carbon content provide sturdy resistance to abrasion, and withstand shocks, fatigue and various complex stresses encountered in crushing, grinding, and other processes of the mining, milling and smelting field. Typical applications include:

- Crusher roll shells
- Tube mill liners
- Grizzlies
- Dredge tumblers and gears
- Cams and tappets
- Crusher frames
- Sheaves
- Pulverizer hammers
- Car wheels
- Kiln tires

FREE...
MAIL COUPON NOW FOR FULL INFORMATION

EMBLEM OF INCO SERVICE

The International Nickel Company, Inc.
Dept. E.&M.J., 67 Wall Street, New York 5, N. Y.

Please send me your 32-page booklet entitled
"NICKEL ALLOY STEEL CASTINGS IN INDUSTRY"

Name.....*Title*.....

Company.....

Address.....

City.....*State*.....

THE INTERNATIONAL NICKEL COMPANY, INC.

67 WALL STREET
NEW YORK 5, N.Y.

One of industry's most pressing needs has been dependable induction motors. It is a need that is now fulfilled by expertly designed E-M Squirrel-Cage Induction Motors, with their indestructible rotors, long-life insulation and cool-running, wear-resistant bearings. Along with the other extra-value advantages of these heavy-duty motors comes E-M job-engineered protection.

DRIP-PROOF—Motor in a mine at Leadwood, Missouri shown above. A strong, steel shield provides protection over a 30° arc, safeguarding the motor against falling liquids or particles.

SPLASH-PROOF—400 hp 1800 rpm motors shown left below are protected over a full 200° arc against damage from water or liquids in paper mill, chemical plant and pumping plant installations.

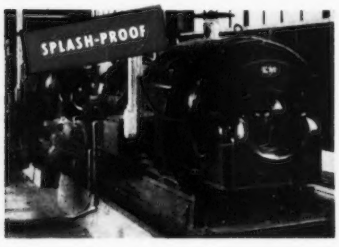
FULLY-ENCLOSED—1000 hp 1800 rpm motors illustrated at right below operating where surrounding air is contaminated with gas. Air entering the motor must be filtered, or drawn from uncontaminated sources.

In the E-M drip-proof motor shown above, —note that the frame flares out at the bottom to accommodate the extra volume of discharge air in that region. This is another instance where E-M's experience in big motor engineering results in more efficient design.

For the full story of what's been happening in induction motor design at E-M, just ask for Publications 189 and 190.

ELECTRIC MACHINERY MFG. CO.
MINNEAPOLIS 13, MINNESOTA

1300-TPA-2077



Types of
E-M SQUIRREL-CAGE
INDUCTION MOTORS

Two-pole; drip-proof; ring lubricated bearings.
Two-pole; drip-proof; pressure lubricated bearings.
Four or more poles; drip-proof; sleeve bearings.
Four or more poles; splash-proof; ball bearings.

AIRCO HARDFACING ALLOYS

add 2 to 25 times
LONGER SERVICE LIFE
to new and worn parts

SEVERE ABRASION

Pug mill knives, coke crusher rolls, mill guides and similar equipment, when hardfaced with Aircolite last many times longer, and at the same time give superior operating efficiency. For *extreme earth abrasion*, Airco Tungtube (tungsten carbide) is recommended.

IMPACT

Parts subjected to impact, like bucket lips, last longer when hardfaced with Airco Electric Self Hardening Alloy. Furthermore, parts can be rebuilt with this alloy at a fraction of new part cost. For *shattering impact*, Airco No. 388 is recommended.

HEAT and CORROSION

Aircoloy 1 and 6 effectively resist wear caused by heat and corrosion . . . for example, parts subject to intense heat, such as ingot tong bits, exhaust valves and seats, tap hole augers, and hot punches, last from 2 to 25 times longer when protected with these NEW Airco Hardfacing Alloys.

BUT TRY A FEW OF THESE NEW AIRCO HARDFACING ALLOYS YOURSELF . . . TAKE ADVANTAGE OF THE SPECIAL INTRODUCTORY LOW PRICE OFFER!

For Only $2.95 you receive a trial assortment of *Aircolite* (for oxy-acetylene and electric application) and Airco Electric Self Hardening Alloys, plus instruction sheets for each of these two alloys and a booklet describing the complete line of Airco Hardfacing Alloys.

• Since this special price is good for a limited time only, we suggest that you fill in and mail the coupon below . . . NOW! Send it to our nearest office or authorized dealer. On West Coast: Air Reduction Pacific Company. Represented Internationally by Airco Corporation (International).

Mail this coupon today for your Special Assortment of the NEW AIRCO HARDFACING ALLOYS

EMJ
Air Reduction, 60 East 42nd Street, New York 17, N. Y.

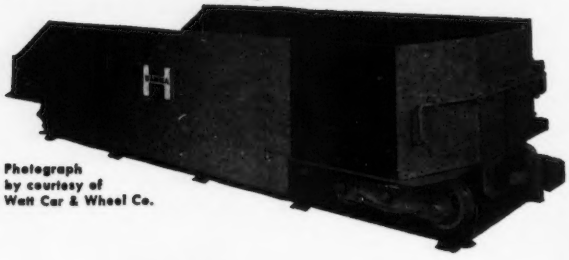
☐ Here is my check for $2.95 — send me the special package of Airco's Hardfacing Alloys.
☐ Send me your booklet: "Airco Hardfacing Alloys" — at NO cost to me.

Firm_____
Signed By_____
Address_____
City & State_____

AIRCO **AIR REDUCTION**
Offices in All Principal Cities

Headquarters for Oxygen, Acetylene and Other Gases . . . Carbide . . . Gas Welding and Cutting Machines, Apparatus and Supplies . . . Arc Welders, Electrodes and Accessories

Photograph
by courtesy of
Southern Car & Mfg. Co.



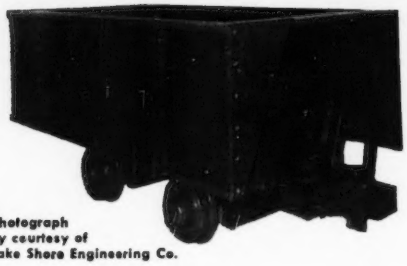
Photograph
by courtesy of
Watt Car & Wheel Co.

FOR

Small Cars

OR

Big Ones



Photograph
by courtesy of
Lake Shore Engineering Co.

WILLISON *automatic* COUPLERS!

Size of car makes no difference in the working advantages of Willison Automatic Couplers. For large cars or small ones, they give you maximum safety, faster handling and lower maintenance cost.

Safety—Willison Automatic Couplers can be operated entirely from the side of the car, eliminating necessity of worker going between cars.

Speed—Completely automatic operation speeds up coupling—greatly facilitates gathering and shunting. Willison Couplers are always ready to couple, operating just as readily when cars are reversed in position.

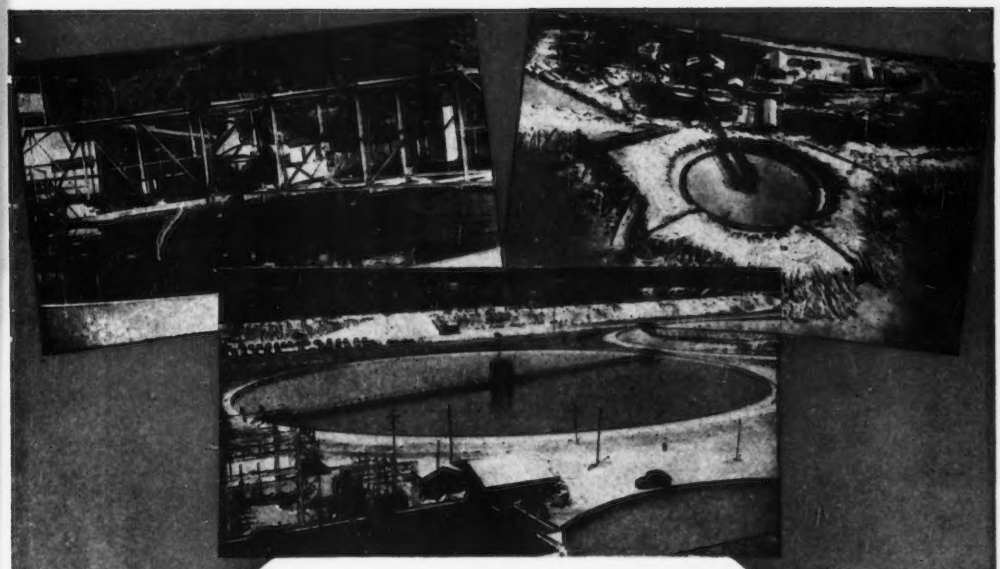
Long Life—Stresses of draft and buffing are received directly by coupler body without interposition of any moving part. Two essential parts, the head and the lock, do the work. Sturdy construction results in greatly reduced coupler and car maintenance.

These advantages of Willison Automatic Couplers have been proved for over twenty years by leading mine operators. We are ready to work with you or your car-builders in the selection of Willison Automatic Couplers for your mine or industrial cars.

Write for Circular No. 5240

NATIONAL MALLEABLE AND STEEL CASTINGS COMPANY
Cleveland, Ohio

NATIONAL *Products*
FOR TRANSPORTATION AND INDUSTRY
Est. 1868



UP-TO-DATE THICKENERS SAVE YOU MONEY EVERY DAY THEY OPERATE

The completely automatic, practically fool-proof operation of General American thickeners and hydroseparators has set new performance standards.

They prevent shutdowns from overload feeds, underflow pump or power failures.

They will take full feed without prescreening or preclassification.

They may be utilized for storage while operating or started by push button control after a prolonged shutdown.

Check your present operations and let a General American engineer assist you in designing new units or modernizing your existing ones.

OTHER GENERAL AMERICAN EQUIPMENT

DRYERS
THICKENERS
DEWATERERS
TURBO-MIXERS
FILTERS
STORAGE TANKS
KETTLES
LADLES
STEEL AND ALLOY
PLATE FABRICATION

GENERAL AMERICAN TRANSPORTATION CORPORATION

Process Equipment Division

SALES OFFICE: 10 East 49th St., Dept. 810, New York 17, N. Y.

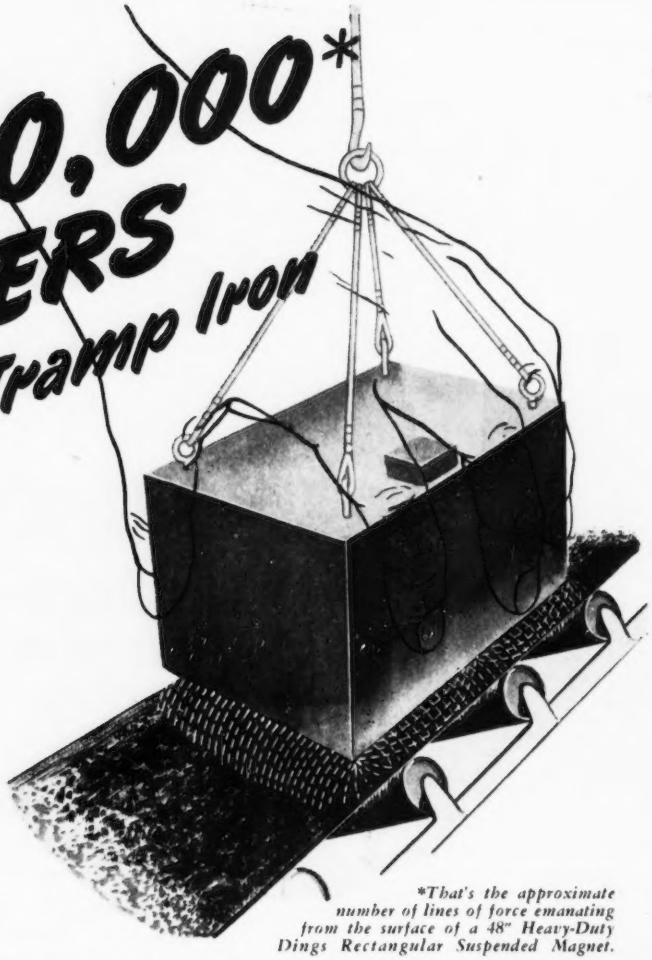
WORKS: Sharon, Pa., East Chicago, Ind.

OFFICES: Chicago, Cleveland, Louisville, Orlando, Pittsburgh, St. Louis, Sharon, Washington, D. C.

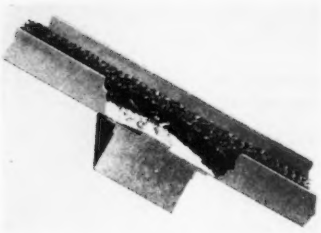
PROCESS EQUIPMENT DIVISION GENERAL AMERICAN TRADE MARK

8,000,000* FINGERS Remove Tramp Iron

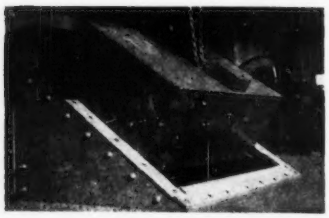
It's the Dings Rectangular Suspended Magnet



*That's the approximate number of lines of force emanating from the surface of a 48" Heavy-Duty Dings Rectangular Suspended Magnet.



The Dings Rectangular Spout Magnet is designed for installation in open or enclosed chutes to remove iron from dry materials or liquids such as coal, ore, rock, chemicals, foodstuffs, and other materials. As material flows over the magnet, iron is attracted and held securely below a step in the face against the downflow of material.



Crusher protection with a Dings Rectangular Magnet installed above chute.

THAT'S a lot of protection for your crushers, pulverizers and other expensive machinery—enough protection to allow heavier loads (up to 15 inches deep) at higher belt speeds—enough protection for the *toughest* tramp iron removal jobs—the kind of protection only a Dings Rectangular Magnet can give you.

And it is done at a low operating cost, with no maintenance—a 30" magnet consumes only 1000 watts.

The whole operation can be made completely automatic. The Self-Cleaning Rectangular Magnet incorporates a cross belt which carries the iron off to the side, deposits it in a receptacle, thus avoiding any labor costs. *Complete removal of damaging tramp iron will save you money—the installation of a Dings Rectangular Magnet can pay for itself in less than a year.*

Write to Dings for a recommendation on a rectangular magnet to answer your tramp iron problem. Ask for CATALOG 301-A.

Dings
"HIGH INTENSITY"
REG. U. S. PAT. OFF.

DINGS MAGNETIC SEPARATOR COMPANY
4716 West Electric Avenue
MILWAUKEE 14, WISCONSIN

WHERE THE GOING IS *Really* TOUGH!

The MARION 151-M is the shovel FOR YOU!
The PROBLEM—How to move a mountain of rock quickly and at low cost with a minimum of maintenance shutdowns.
The SOLUTION — A MARION 151-M, 6½ cubic yard shovel, designed for continuous service in rock.
MARION
151-M

Send today for Bulletin 393 giving the complete story of the MARION 151-M.

MARION

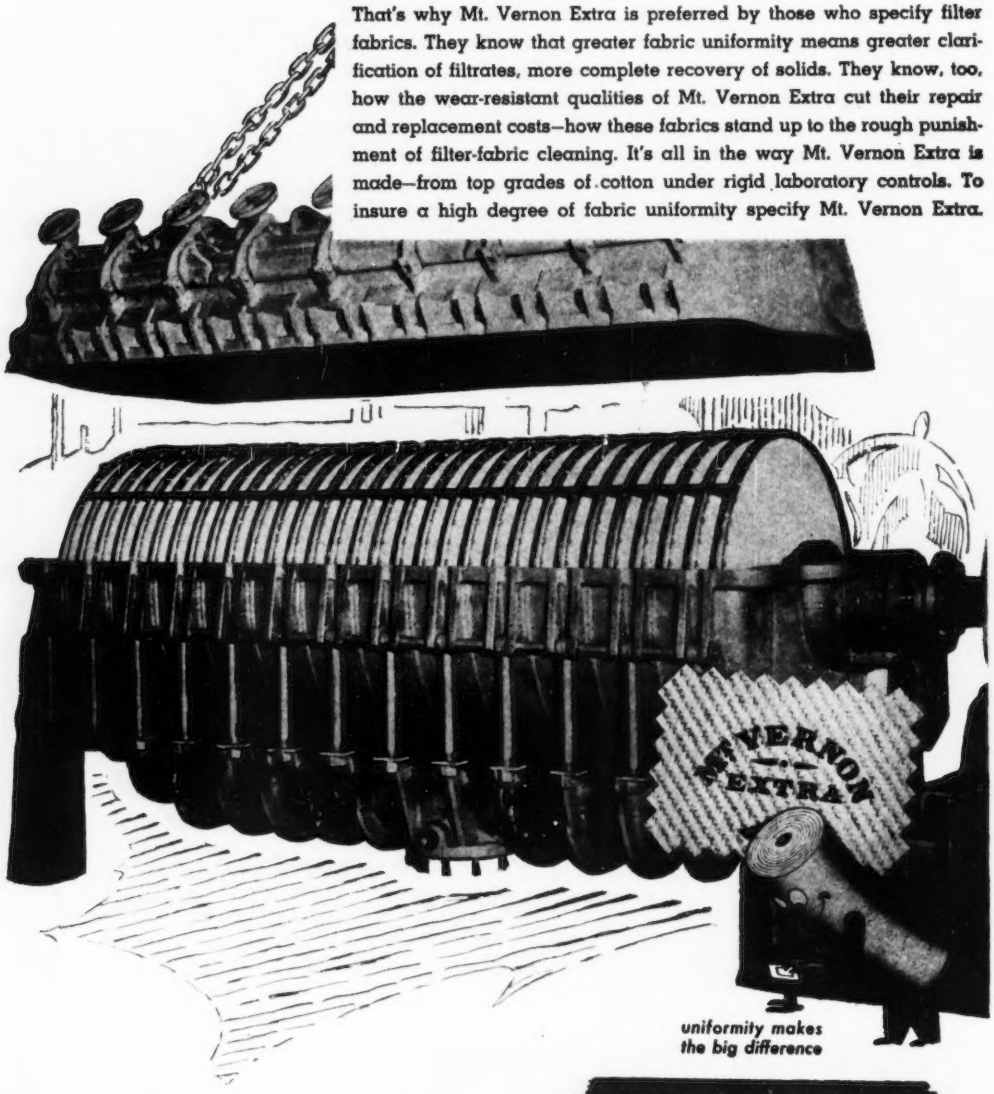
POWER SHOVEL COMPANY

MARION, OHIO, U. S. A.

Offices and Warehouses in all Principal Cities

Filtering Starts with the Fabric

Filtering efficiency depends to a great degree on fabric uniformity. That's why Mt. Vernon Extra is preferred by those who specify filter fabrics. They know that greater fabric uniformity means greater clarification of filtrates, more complete recovery of solids. They know, too, how the wear-resistant qualities of Mt. Vernon Extra cut their repair and replacement costs—how these fabrics stand up to the rough punishment of filter-fabric cleaning. It's all in the way Mt. Vernon Extra is made—from top grades of cotton under rigid laboratory controls. To insure a high degree of fabric uniformity specify Mt. Vernon Extra.



uniformity makes the big difference

Mt. Vernon-Woodberry Mills

TURNER HALSEY
COMPANY
Selling Agents
40 WORTH ST. • NEW YORK

Branch Offices: CHICAGO • ATLANTA • BALTIMORE • BOSTON • LOS ANGELES • AKRON

BOOM Down

ON PRODUCTION COSTS WITH . . .

PRIMACORD

YOU'RE taking a big bite out of digging costs when you blast with Primacord. Because Primacord hook-ups help produce the kind of well-broken rock that makes digging easier. And better digging speeds operations all along the line.

Primacord makes this possible through a combination of forces that work as a hard-hitting team. You plan trunk lines so that front row holes shoot a split-second before succeeding rows. You load down hole lines so that the Primacord contacts every cartridge. When you fire, every cartridge in the load explodes at full power.

A non-conductor of electricity, Primacord is insensitive to stray currents . . . hooks up with simple square knots and half hitches . . . is wound on light weight spools in three grades to meet every blasting condition. Ask your supplier which grade you should use; or write direct to The Ensign-Bickford Company, Simsbury, Connecticut. P-25

PRIMACORD-BICKFORD

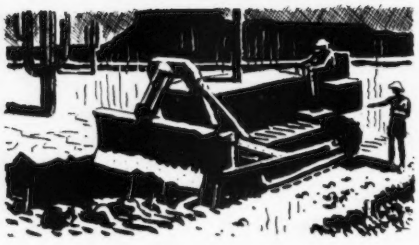
Detonating • Fuse •

Also Ensign-Bickford Safety Fuse Since 1836

NOW! SIMPLIFIED LUBRICATION!

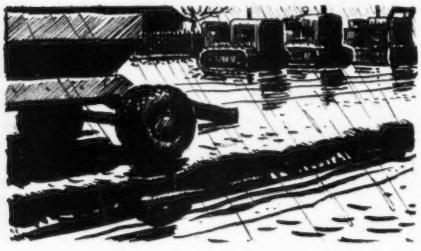
Multi-purpose UNOBA

Does the Jobs of Many Greases

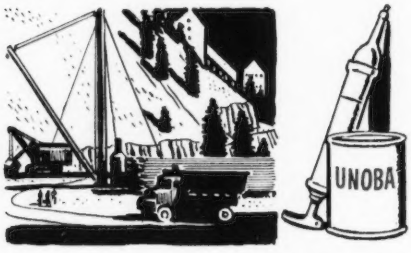


1. UNOBA simplifies your lubrication because it does the jobs that formerly required many different types, grades and brands of greases. UNOBA can do this because it resists *both* heat and water and can be used under almost all operating conditions.

2. You'll be amazed at the protection your equipment gets with UNOBA. Neither boiling water nor dry heat can cut its tenacious film. UNOBA maintains its smooth, buttery texture at temperatures from below freezing to 300° F.!



3. UNOBA gives the greatest possible defense against rust and corrosion. Because of its unusual adhesive quality and its heat and water resistance, UNOBA protects even idle equipment over long periods.



4. UNOBA reduces costs, saves you time! With UNOBA you need use only one gun and one container in most cases. Thus this multi-purpose grease holds stock inventory to a minimum, saves you time and cuts equipment costs.

For full information phone your local Union Oil Representative or write Sales Department, Union Oil Company, Los Angeles 14, California.

76 UNOBA

UNION OIL COMPANY OF CALIFORNIA

2,000,000 tons of ore on original bearings

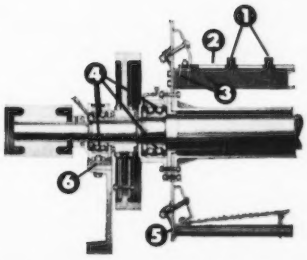
●At this iron mine near Buhl, Minnesota, a PIONEER MESABI SCALPING SCREEN recently completed its fifth season of operation without major repairs. During this period more than 2,000,000 tons of iron ore were screened on the original bearings *. . and it's still going strong!*

While this is a great tribute to the SKF bearings, it is a far greater tribute to the balance and rugged construction built into all PIONEER MESABI SCREENS. For, as mining men know, an unbalanced screen can ruin the best set of bearings in a short time.

Though neither the largest nor the strongest of the screens that PIONEER has furnished to the mines, this 5'x 8' MESABI typifies what you can expect when you install screens by PIONEER.

When you need heavy-duty screens, feeders, conveyors, jaw crushers or roll crushers, you'll find your answer in PIONEER MINING EQUIPMENT. It's built to give you higher output, with lower upkeep. Orders placed now will receive prompt attention.

PIONEER ENGINEERING WORKS
1515 Central Avenue • Minneapolis 13, Minnesota



CHECK THESE CONSTRUCTION FEATURES OF PIONEER MESABI SCREENS

1. **LONGITUDINAL STEEL BARS** lengthen life of screen.
2. **SCREENING DECK** built from punched steel plate or heavy wire cloth.
3. **FIRM SCREEN SUPPORT** provided by longitudinal angle iron reinforcing and channel iron cross-bracing.
4. **SKF SPHERICAL, SELF-ALIGNING BEARINGS**— fully enclosed and sealed with all metal grease seals.
5. **BALANCED PAN** gives positive screening action at both ends of screen as well as in the center regardless of load.
6. **HEAVY MAIN FRAME** is cross-braced with angles. Longitudinal bracing includes extra plates under bearings.
7. **SIZES**—4 x 10, 4 x 12, 5 x 8, 5 x 10, 5 x 12, 5 x 14 with single and double decks.

Pioneer *Continuflo* **EQUIPMENT**

PIONEER ENGINEERING WORKS
1515 Central Avenue, Minneapolis 13, Minnesota

● Please send me information on the equipment checked below:

☐ Mesabi Screens	☐ Roll Crushers
☐ Oro Feeders	☐ Jaw Crushers
☐ Conveyors	☐ Washing Plants

Name_____

Company_____

Street_____

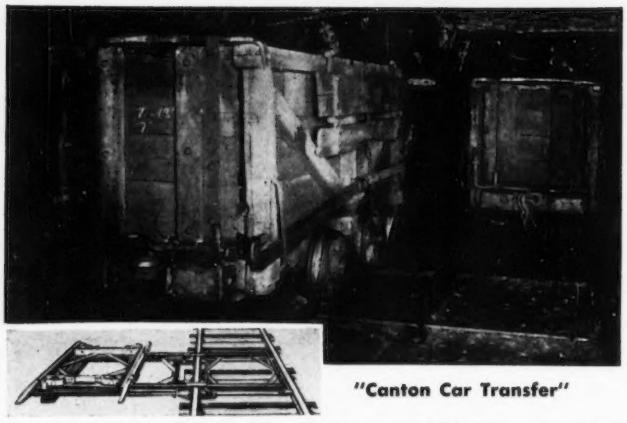
City_____ State_____

Load an entire train on single track

for **PROFIT**

Save Time
Save double track
with the

"Canton Car Transfer"...



"Canton Car Transfer"

THIS famous economy device can be installed on any track of gauge and rail now in use. Its operation is simplicity itself—pushing empty car on track by locomotive, then moved by hand to transfer section, permitting locomotive and cars to pass. Train is pulled out all at one time. Two men in two minutes can take down, to move the three units to new location when desired . . . no alterations required for track or rails. Timken Roller Bearings enable easy shunting of heavy cars to maximum weight of six tons. The Car Transfer speeds up loading, haulage, saves expensive double-tracking. Write for complete literature; please use street and zone numbers.

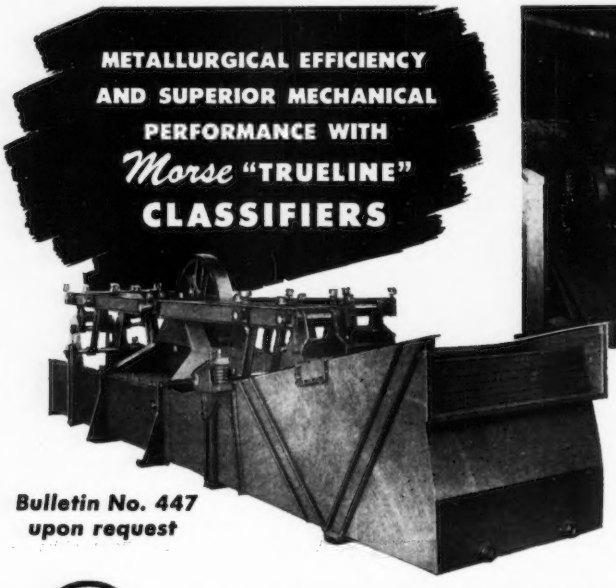
American Mine Door Co.

2039 Dueber Avenue
Canton 6, Ohio

Manufacturers of "Dustributors"; Automatic Switch Throws; Automatic Mine Doors; Mechanical Track Cleaners

METALLURGICAL EFFICIENCY AND SUPERIOR MECHANICAL PERFORMANCE WITH

Morse "TRUELINE" CLASSIFIERS



Bulletin No. 447 upon request

Smooth in performance—simple to operate and maintain—large pool area—built for hard and continuous duty. The uniform "Trueline" rake movement improves results, increases sand raking capacity and minimizes maintenance.

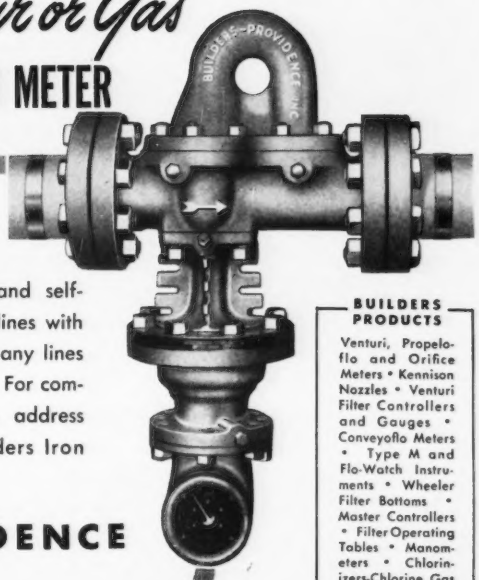
MB

MORSE BROS. MACHINERY CO.

ESTABLISHED 1898

P. O. BOX 1708 • DENVER, COLORADO, U. S. A. • CABLE "MORSE"

Put a PRICE TAG on Steam, Air or Gas with BUILDERS SHUNTFLO METER



Get full value from every pound of steam or cubic foot of air or gas by metering with Builders Shuntflo Meter. This self-contained and self-actuated unit registers the flow through pipe lines with extremely high accuracy. It's easy to install in any lines from 1" to 14" and requires little maintenance. For complete information and new Bulletin 400-F1, address Builders-Providence, Inc., (Division of Builders Iron Foundry), Providence 1, R. I.

BUILDERS PROVIDENCE
Instruments

BUILDERS PRODUCTS

Venturi, Propeloflo and Orifice Meters • Kennison Nozzles • Venturi Filter Controllers and Gauges • Conveyoflo Meters • Type M and Flo-Watch Instruments • Wheeler Filter Bottoms • Master Controllers • Filter Operating Tables • Manometers • Chlorinizers-Chlorine Gas Feeders • Chronoflo Telemeters

OSSCO GEIGER COUNTERS GET RESULTS!

Writes Ernest Johnson of British Columbia—
"We are now using your counters in various parts of Canada and find them giving excellent service under the most rugged conditions."

Says Dr. C. G. Ridland of Denver—
". . . it is the best instrument of its kind that we have had the pleasure to use and we congratulate you. We particularly like the rate meter attachment."

A Typical Comment—
"OSSCO counters are built stronger and give better results in the field."
—RET, Idalo.

The TX-9 is the most recent addition to the famous line of OSSCO Geiger counters. Light weight, efficient.

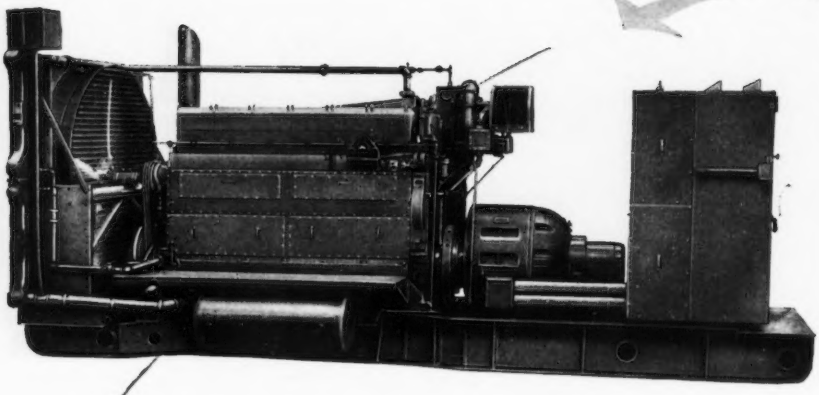
New Fields of Radioactive Ores Located

Prospectors uncover hitherto unknown fields of radioactive ore deposits. In the past year vast new locations have been found in Ontario, California, New Mexico, and Arizona. Radioactive ore deposits of some value have been reported in all but a few of the 48 states, and reports say that important new strikes are impending in North Carolina, Idaho, Michigan and Tennessee.

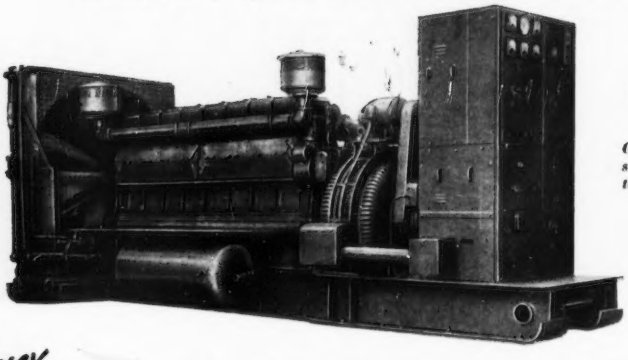
• OSSCO researchers, working hand-in-hand with prospectors and mining engineers, have set the pace for improvements and modifications for all types of Geiger counters. Solid new designs of OSSCO Geiger counters are presented every year. Clean, simple instruments, free from complicated gadgetry and built to be dependable under rough field use.

Find that Uranium! For specifications and prices of Geiger counters to meet your specific needs, write

OMAHA SCIENTIFIC SUPPLY CO. DEPT. MJ 3601 N. 24, OMAHA 10, NEBRASKA



At the very spot where power is needed



Complete range of sizes from 90 KW to 1200 KW.

EFFICIENCY PLUS ECONOMY

LOW FUEL CONSUMPTION results from efficient design of combustion chamber, valve mechanism and fuel injection system.

INSTANTANEOUS STARTING is assured by simple starting valve which admits air through distributor. The distributor, in turn, admits air at timed intervals to each cylinder.

DUST-TIGHT COVERS completely enclose all wearing parts, but are easily removed for inspection.

LUBRICATION is completely automatic force feed, resulting in exceptionally low maintenance.

EVERY PART is designed with ample strength for maximum rigidity with minimum weight assuring long service life.

CP PACKAGE UNITS . . . Diesel or Dual-Fuel Generator Sets . . . are another outstanding achievement of Chicago Pneumatic's thirty-four years' experience in engine building.

Designed to meet mining needs for a complete, conveniently transportable source of power for remote locations. Easily installed, instantly started, these units are readily adaptable to every power requirement.

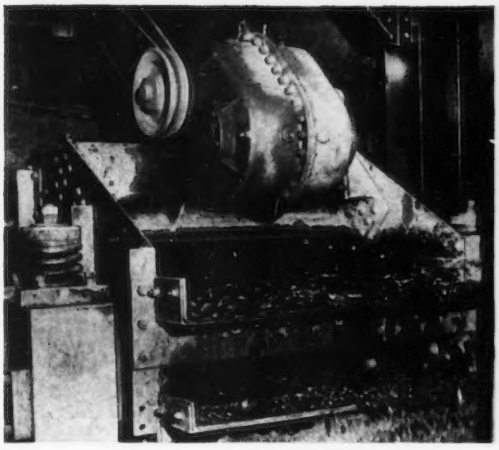
Furnished complete with piping, wiring, and all accessories . . . ready for operation . . . they can be set up quickly and easily . . . with minimum installation expense. Write today for complete information.

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

Wedge-Slot Screen in concentrator plant



In this 4′ x 8′ double-deck vibrating screen in use in one of the world's largest concentrator plants, a Hendrick Wedge-Slot Screen with type C-12 profile bars and 1/16″ slot openings is used on the lower deck.

The C-12 profile bars, 12/64ths of an inch wide, are designed for heavy duty service, and the slots extend uninterruptedly the entire length of the screen.

Write for full information on the many advantages of using Wedge-Slot Screens.

SEE OUR CATALOG IN SWEET'S

HENDRICK

Manufacturing Company

Perforated Metals
Perforated Metal Screens
Architectural Grilles
Milco Open Steel Flooring
"Shur-Site" Treads and Armorgrids

70 DUNDAFF STREET, CARBONDALE, PENNA.

Sales Offices in Principal Cities

HINGED PLATEGRIP
BELT FASTENERS (No. 500)

for heavy conveyor belts of changing length

Bolt on belt ends (any width), make a strong flush, flexible joint that can be coupled, uncoupled or added-to by simply pulling flexible hinge pin. Troughs readily, rides smoothly over flat or crowned pulleys. Designed for heavy conveyor belts.

Write for Catalog

ARMSTRONG-BRAY & CO.
5322 NORTHWEST HIGHWAY
CHICAGO 30, ILLINOIS

DIAMOND CORE DRILLING

Contractors

Electric, AIR & GASOLINE DRILLS
FOR TESTING ALL MINERAL PROPERTIES

Pressure Grouting for Mine Shafts and Wet Entries
Inside Mine Drills, Drainage Holes

MOTT CORE DRILLING CO.
Huntington, W. Va.

FLEXCO

BELT FASTENERS AND RIP PLATES

FOR HEAVY CONVEYOR AND ELEVATOR BELTS OF ANY WIDTH

FLEXCO Fasteners make a tight, butt joint of great strength and durability . . . distribute the strain uniformly. Operate smoothly over flat, crowned or take-up pulleys. Made of steel, Monel, Everdur and Promal.

FLEXCO Rip Plates are for repairing and patching damaged belts.

Ask for Bulletin F-100

FLEXIBLE STEEL LACING COMPANY
4635 Lexington St., Chicago 44, Illinois

Strong, Smooth and Readily Troughing.
Order From Your Supply House

Professional Services

ASSAYING
CONSULTING
PROSPECTING
ORE TESTING

RESEARCH
METALLURGY
MILL DESIGN
MINE MANAGEMENT

AERO SERVICE CORP.
Worldwide Mapping Facilities
Topographic Maps
Precise Aerial Mosaics
Airborne Magnetometer Surveys
236 E. Courtland Street
Philadelphia 20, Pa.

ABBOT A. HANKS, Inc.
ASSAYERS—CHEMISTS
Shippers Representatives
621 Sacramento Street
San Francisco

ARNOLD H. MILLER
Consulting Engineer
General Mine, Mill and Industrial Appraisals
Plant Design, Mechanization and Improvement
Cable: "ALMIL." Tel. Cortland 7-0635
120 Broadway, New York 5

SEWELL THOMAS
Consulting Mining Engineer
Plant Layout, Design, Detailing, Mechanization, Mining Methods
380 Gilpin St. Denver 3, Colo.

AGENCE MINIERE & MARITIME S.A.
Sworn weighers, samplers & Assayers of Ores, Metals. Representatives of shippers at European ports & Works.
Market surveyors and commercial advisers assuring sales direct to consumers
2, rue Van Bree, Antwerp (Belgium)

E. LEE HEIDENREICH, JR.
Consulting Engineer
Storage Methods — Quarries
Crushing Plants — Plant Layout
Milling Plants — Appraisals
Concrete Products — Plant Design
67 Second St., Newburgh, New York

ARTHUR NOTMAN
Consulting Mining Engineer
40 Wall St., 19th Floor
New York N. Y., U.S.A.
Telephone WHitehall 4-4298

DONALD STEEL
Mining Engineer
2000 Bryant Street
Palo Alto, California

BEHRE DOLBEAR & COMPANY
Consulting Mining Engineers and Geologists
11 Broadway, New York 4, N. Y.

JOHN HERMAN
Assayer and Chemist
QUALITATIVE SPECTROGRAPHIC ANALYSIS
I Do Not Guarantee Satisfaction
I Guarantee Accuracy
920 Santee Street
Los Angeles, Calif.

RODGERS PEALE
Consulting Mining Geologist
315 Montgomery Street
San Francisco 4, Calif.

MARVIN J. UDY
Inorganic Chemistry Electrochemistry
Electric Furnace Smelting Process Metallurgy
Ferro-Alloys, Calcium Carbide, Phosphorus
Telephone 2-6294
516 Pottage Rd. Niagara Falls, N. Y.

BLANDFORD C. BURGESS
Consulting Engineer
Industrial Mineral Specialist
Appraisals — Mineral Surveys
Plant Design
Prospecting Development—Efficiency
Ground Water Studies
Box 350 Monticello, Ga.

HERON ENGINEERING CO.
Surveys, Reports, Designs and Estimates for Mine, Metallurgical and Industrial Installations, Including Power Plants, Railroads, Tramways, Water Supply and Waste Disposal Systems.
2000 South Acoma, Denver 10, Colorado
Chama, New Mexico

ROGER V. PIERCE
Mining Engineer
Specialist
Underground Mining Methods. Cost Cutting Surveys—Production Analysis
Mine Mechanization—Mine Management.
49 E. 9th So. Salt Lake City 4, Utah

LELAND A. WALKER
Consulting Mining Engineer
Management, Underground Mine Methods
Analysis & Costs, Examinations
146 South West Temple Street
Salt Lake City 1, Utah

GLENVILLE A. COLLINS
Mining Engineer
Specializing in Uranium Examinations
210 La Arcada Bldg.
Santa Barbara, Calif.
and
513 Royal Bank Bldg.
Vancouver, B. C., Canada

C. C. HUSTON
Consulting Mining Engineer
Negotiations — Exploration
Examinations — Development
Canada and South America
1001 85 Richmond St. W.
Toronto Ontario
Telephone Adelaide 6237

LUCIUS PITKIN, INC.
Mineralogists—Assayers
Chemists—Spectroscopists
SHIPPERS REPRESENTATIVES
Main Office—Laboratories
Pitkin Bldg.—47 Fulton St.
New York 7, N. Y.

WALKER & WHITE, Inc.
Umpire, Assayers, Chemists
Shippers Representatives
109 Pearl St. New York City

CHESTER A. FULTON
Consulting Mining Engineer
10 East 40th St. New York City 16
Murray Hill 9-1530
302 Somerset Rd. Baltimore 10, Md.
Belmont 1353

LEDOUX & CO.
Assayer, Sampler and Weighers, Representatives of Shippers of Ores and Metals at Buyer's Works. We are Not Dealers or Refiners.
Offices and Laboratories
155 Sixth Ave., New York

LEWIS SANDERS
Consulting Engineer
Examinations, Reports, Mill and Power Plant Design
601 East 20th St., New York 10, N. Y.
Telephone GRamercy 7-1356

W. T. WARREN
Mining Engineer-Consultant
Do you have a problem? We are used to tough ones!!
Mine Plant—Operating—Methods—Planning—Development
Rt. 1, Box 181 Phone
Reno, Nevada Reno 2-2938

GEOPHYSICAL ENGINEERING CORP.
(Delaware Incorporated 1935)
Joshua L. Soske, President
Geophysical Consultants & Contractors
170 East Orange Grove Ave., Pasadena
Mailing Address: P.O. Box 7, Sta. C
Pasadena 5, California
Telephone: SYcamore 6-1247
Cable Address: GEOCORP, Pasadena

MARK C. MALAMPHY & CO., LTD.
Consulting Geologists and Geophysicists
Experienced field crews available for examinations and surveys anywhere in Africa
P. O. Box 209, Mufulira, Northern Rhodesia

SARATOGA LABORATORIES, INC.
Research—Consulting—Analysis
Spectrographic Analysis—X-ray Diffraction—Petrography—Metallography
Laboratory—Saratoga Nat'l Bank Bldg.
Saratoga Springs, N. Y.

HARRY J. WOLF
Mining and Consulting Engineer
Examinations — Valuations — Management
420 Madison Avenue,
New York 17, N. Y.
Cable: MINEWOLF
Tel.: Plaza 9-1700

THE GULICK-HENDERSON LABORATORIES, INC.
Assayers and Analytical Chemists
Shippers Representatives
524 Fourth Ave., Pittsburgh 19
431 South Dearborn St., Chicago 5
25 West 43rd St., New York 18

ROBERT B. McELWAINE
Member Aime
Consulting Mining Geologists
Rector Building
Little Rock, Arkansas
Telephone 2-1434

PAUL F. SCHOLLA ASSOC.
Mining Engineers
Metal & Non-Metallic Mineral Mining
Examination — Management
Development — Surface Plant Design
Financing
1025 Connecticut Ave., N.W.
Washington 6, D. C.

J. W. WOOMER & ASSOCIATES
Consulting Mining Engineers
Modern Mining Systems and Designs
Foreign and Domestic Mining Reports
National Bank Bldg., Wheeling, W. Va.

HAMILTON, BEAUCHAMP & WOODWORTH
Metallurgical and Mechanical Consulting Engineers
DESIGN, CONSTRUCTION, OPERATION OF MILLING PLANTS
564 Market Street
San Francisco, California

CALL IN A SPECIALIST TO SOLVE THAT PROBLEM

Experiment takes time—so why not save time by calling in a specialist who has already gone over the ground you are now exploring?

Engineering & Mining Journal, meeting place of mining men in all parts of the country, points the way to the solution of many milling problems through its Professional Service Section.

Why not tell one of these specialists about YOUR problems?

MERRICK · MERRICK · MERRICK · MERRICK · MERRICK · MERRICK

CONTROLS FEED BY WEIGHT — TOTALIZES WEIGHT

The Merrick FEEDOWEIGHT (Reg. U. S. Pat. Off.) is just what the name suggests — a reliable and automatically controlled scale mechanism that accurately controls feed by weight of ore moving along a conveyor. Self contained. Feed rate may be varied. Large feed opening assures even flow. The weight of materials fed is also automatically totalized. Easy to install and maintain. Durable. Simple. Long life because of slow-moving parts. Bulletin 551.

GET CONVEYOR RECORDS YOU CAN TRUST

The Merrick Weightometer (Reg. U. S. Pat. Off.) has proven its accuracy for more than 35 years weighing valuable ores wherever mined. Without interrupting the flow of materials or the movement of the conveyor (horizontal or inclined) it keeps a continuous and accurate record of weight then being moved — also totalized. These registers and records may be given at point of contact or anywhere else it is most convenient. When you invest in mechanisms like those, upon whose performance depends your production and profits — remember

MERRICK EXPERIENCE *COUNTS!* **Bulletin 375**

MERRICK SCALE MFG. CO. · PASSAIC · NEW JERSEY · U.S.A.

MERRICK - The Weigh to Save Time and Money

MERRICK · MERRICK · MERRICK · MERRICK · MERRICK · MERRICK

CLASSIFIED ADVERTISING

for bringing business needs or opportunities to the attention of men associated in administrative, executive, management, sales and responsible technical, engineering and operating capacities with the industries served by

The SEARCHLIGHT SECTIONS of

Air Transport
American Machinist
Aviation Week
Bus Transportation
Business Week
Chemical Engineering
Coal Age
Construction Methods
Electrical Construction & Maintenance
Electrical Merchandising
Electrical World
Electronics
Engineering News-Record
Engineering and Mining Journal
E & M J Markets
Factory Management and Maintenance
Food Industries
Power
Product Engineering
Textile World
Welding Engineer

For advertising rates or other information address:
Classified Advertising Division

McGRAW-HILL PUBLISHING CO., Inc.
330 W. 42nd St., New York 18, N. Y.

BUILT FOR THE BIGGEST DE-WATERING JOBS

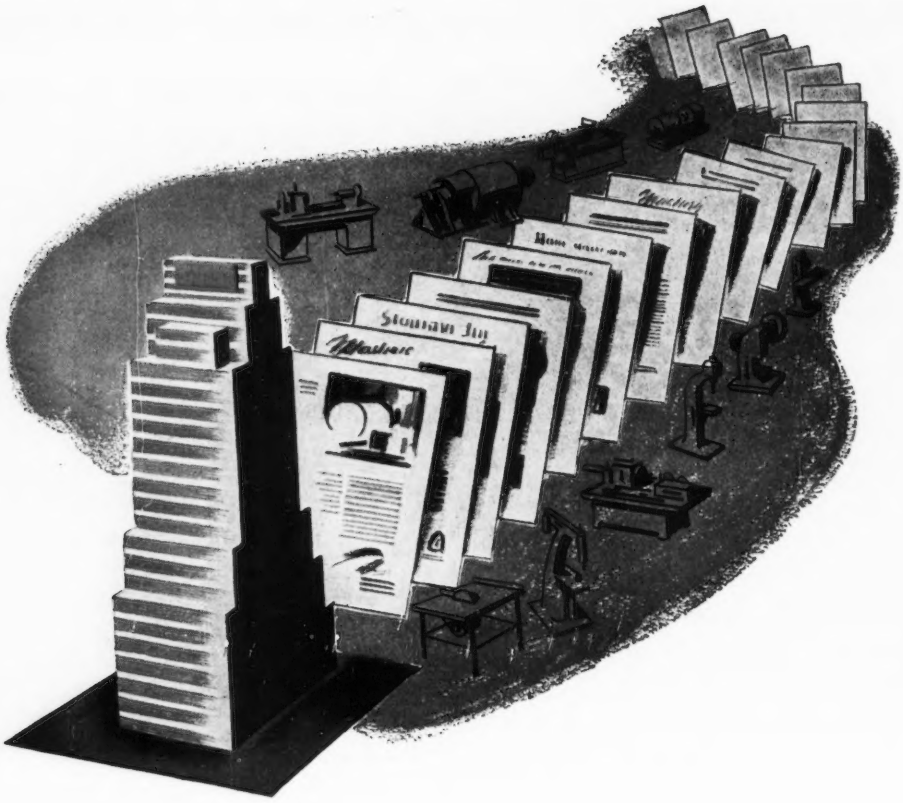
If you want big ruggedly built pumps that will handle the toughest de-watering jobs at low operation cost, get the facts on Layne Vertical Turbine Pumps. They're built to handle tremendous quantities of water at a new low in operation cost. Layne Verticals are used in the biggest mines of North and South America. Now available in all sizes.

Layne Vertical Turbine Pump catalog explains the unduplicated features of pumps built for the toughest mine dewatering jobs. Write for a copy today.

LAYNE & BOWLER, INC.
General Offices
MEMPHIS 8, TENN.

LAYNE

VERTICAL TURBINE PUMPS



The Parade that has no End

As you go through the pages of this magazine . . . or of any other McGraw-Hill publication . . . a colorful parade of advertising pages unfolds before your eyes.

If you are like thousands of other readers of these magazines, you'll become an avid spectator of this interesting educational show. You'll take in the *whole* of this passing parade.

Why? Because this parade is a non-stop exhibition of all that's new in industry—new developments in products and services, new ways for the buyer to make use of these products, news which can often mean the difference between profit and loss to you.

That's why readers of McGraw-Hill magazines are cover-to-cover readers. That's why they're *regular* readers . . . *serious* readers. That's why men say: FOR THE FACTS OF *INDUSTRIAL* LIFE, TURN TO McGRAW-HILL.

McGRAW-HILL

Publishing Company, Inc., 330 West 42nd Street, New York 18, N. Y.

HEADQUARTERS FOR INDUSTRIAL INFORMATION

The McGraw-Hill Network of Industrial Communication: American Machinist • Air Transport • Aviation • Aviation News • Bus Transportation • Business Week • Coal Age • Chemical Engineering • Construction Methods • Electrical Contracting • Electrical Merchandising • Electrical West • Electrical Wholesaling • Electrical World • Electronics • Engineering & Mining Journal • E. & M. J. Metal and Mineral Markets • Engineering News-Record • Factory Management & Maintenance • Food Industries • McGraw-Hill Digest • Mill Supplies • Power • Product Engineering • Science Illustrated • Textile World • The Welding Engineer.

ASCO DIAMOND CORE BITS

NEW Powdered Metal Bits

Ascolite Bits Tungsten Matrix with a Rockwell C Hardness of 55-60.
Nicolite Bits Tungsten Matrix with a Rockwell 3 Hardness of 40-45.
Bronzolite Bits Tungsten Matrix with a Rockwell C Hardness of 25-30.

Crown sintered onto blank Strips for Reaming Shells

ANTON SMIT & CO., INC.
333 West 52nd Street, New York 19, N. Y.

"The Right Bit for Every Condition"
Testimonials from users. Ask for literature.

CORE DRILLING
—anywhere!

"We look into the Earth"

- Mineral Prospecting
- Foundation Test Borings and Grouting
- Large diameter holes for Ventilation and Escapeways

PENNSYLVANIA Drilling CO.
DRILLING CONTRACTORS & MFRS.
1205 Chartiers Ave. PITTSBURGH, PA. WAlnut 1-5816

HILLMAN DRILLS
AND
SAMPLING EQUIPMENT
WILL
TEST YOUR PLACER DEPOSITS
MOST
ECONOMICALLY — ACCURATELY

— WORLD PLACER HEADQUARTERS —

C. KIRK HILLMAN CO.
3201 1st Ave. South SEATTLE, WASH

PLACER GOLD

Most accurately and economically tested for . . . with the

EMPIRE DRILL
NEW YORK ENGINEERING COMPANY
75 West St., N. Y. City, U.S.A. Cable Address NYECO, N.Y.

REPLIES (Box No.): Address to office nearest you.
NEW YORK: 330 W. 42nd St. (18)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

SEARCHLIGHT SECTION
Classified Advertising

EMPLOYMENT: "OPPORTUNITIES" :EQUIPMENT
BUSINESS: :USED OR RESALE

SELLING OPPORTUNITY OFFERED

EXPORT SALES Representatives for both inside and outside positions. Preference will be given to qualified salesmen having technical or practical engineering training. Applicant should be under 36 years of age. Knowledge of heavy construction and mining machinery preferred. Write full particulars in first letter and enclose recent photo. Our sales organization knows about this ad. Write RW-1180, Engineering & Mining Jl.

POSITIONS WANTED

CYANIDE MILLMAN. Foreman, shifter, desires position, many years' experience, large and small plants, technical background, age 44. Best references. Foreign locations, States and Mexico preferred. PW-9333, Engineering & Mining Jl.

MASTER MECHANIC, 28, married. BS degree in mining engineering. Practical experience in ore and acetylene welding, operation of lathes and other shop equipment, truck and auto repair. Good record in personnel relations with subordinates and superiors. Three years' experience in setting up mine plants on new properties. Desires position in U. S. Available after January 1. PW-1205, Engineering & Mining Jl.

MINING GRADUATE now employed as Superintendent of large mine in S. A. Available reasonable notice. Age 34, married, 11 yrs., experience underground, all capacities. Location not important if with family. Details on request. PW-1211, Engineering & Mining Jl.

MANAGER 20 years progressive, successful foreign and domestic mine operation, extensive knowledge in dealing with mining, metallurgical and administrative problems, speak Spanish, available on consultant or full time engagement. PW 1274, Engineering & Mining Jl.

WANTED IMMEDIATELY

GENERAL MANAGER for large property, South America. Altitude and unusual operating conditions. Young aggressive engineer preferred with background. Latin-American operating experience essential. Salary $15,000.00 annually. Replies strictly confidential.

P1285—Engineering & Mining Journal,
330 W. 42nd St., New York 18, N. Y.

POSITIONS WANTED

MINING ENGINEER. 42, married, two children, B.S. degree in mining. Eighteen years' experience underground metal mine development and production, mainly supervision in western states. Willing to go anywhere. PW-1287, Engineering & Mining Jl.

MANAGER OR Assistant, graduate mining engineer, fluent Spanish, capable executive, experienced in labor relations, demonstrated ability in charge of large development and mining operations. PW 1272, Engineering & Mining Jl.

BUSINESS OPPORTUNITY

Arizona Gold Mine
comprising 6 claims. Excellent production past. Attractive price. BO 1271, Engineering & Mining Jl.

(Continued on page 196)

WANTED

Large engineering firm wishes to acquire several complete plants through purchase of (1) capital stock, (2) assets, (3) machinery and equipment whole or in part. Personnel retained where possible, strictest confidence.

Box 1231, 1474 Broadway, New York 18, N. Y.

WANTED

Capital for mill and development work, or will sell or lease to responsible parties, principals only.

Have 55 thousand tons gold ore blocked. 30 thousand tons $10.50 ore.

25 thousand tons $7.50 ore.

50,000 or more indicated by pits, trenches and tunnels, average $5.00 per ton.

Large area covered by overburden.

Another large area partially exposed, 150 ft. wide, average $3.50.

Approximately 200 acres, title mining location.

Gravity spring water, sufficient for 100-ton mill.

Also approximately 340 acres of lead, gold, silver and zinc claims, shipping now. Last car net $45.00 per ton, saved from development work. Grade of ore can be increased at least 50% by selective mining.

HARRY E. BRIGGS, Owner
Box 613, Trona, California.

APPR. 200 ACRES
PATENTED MINERAL CLAIMS
One Block. Near Castle Dome Mine. Sulphide Ore. $15.00 per Acre.
WEST END MINING CO.
1921½ Maple Ave., Los Angeles 11, Calif.

Additional Opportunity Advertising on page 196

• **STRIPPING CONTRACTOR**

wants a 50,000,000 Cubic Yard or larger project.

• **HAVE EXPERIENCED CREW,**

equipment, core drill, etc., available.

• **PREFER WORK IN UNITED STATES**

or Canada; but will consider work elsewhere.

RUSSELL BADGETT
3251 Southern Avenue
MEMPHIS, TENNESSEE

BUSINESS OPPORTUNITY

(Continued from page 195)

Wanted Party to Drill
our igneous dike, already cut into lease, part drilling, sell some zinc, some uranium, write samples. L. J. Hobby, Princeton, Ky.

LEGAL NOTICE

STATEMENT OF THE OWNERSHIP, MANAGEMENT, AND CIRCULATION REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233)

Of Engineering & Mining Journal, published monthly at Chicago, Illinois, for October 1, 1949.

1. The name and address of the publisher, editor, and business manager is: Publisher, McGraw-Hill Publishing Co., Inc., 330 West 42nd St., New York 18, N. Y.; Editor, Evan Just, 330 West 42nd St., New York 18, N. Y.; Managing Editor, A. H. Hubbell, 330 West 42nd St., New York 18, N. Y.; Business Manager, Reginald W. Davis, 330 West 42nd St., New York 18, N. Y.

2. The owner is: McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York 18, N. Y.; Stockholders holding 1% or more of stock: Curtis W. McGraw, Executor of the Will of James H. McGraw, 330 West 42nd St., New York 18, N. Y.; James H. McGraw, Jr., Curtis W. McGraw and Willard T. Chevalier, Trustees for: Harold W. McGraw, James H. McGraw, Jr., Donald C. McGraw, Curtis W. McGraw, all of 330 West 42nd Street, New York 18, N. Y.; James H. McGraw, Jr., and Curtis W. McGraw, Trustees for Catherine Osmun, 330 West 42nd Street, New York 18, N. Y.; Edwin S. Wilsey and Curtis W. McGraw, Trustees for James H. McGraw, 3rd, Madison, New Jersey; James H. McGraw, Jr., 330 West 42nd Street, New York 18, N. Y.; Curtis W. McGraw, 330 West 42nd Street, New York 18, N. Y.; Donald C. McGraw, 330 West 42nd Street, New York 18, N. Y.; Mildred W. McGraw, Madison, New Jersey; Grace W. Mehren, 526 Arenas St., LaJolla, Calif.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

McGRAW-HILL PUBLISHING COMPANY, Inc.
By J. A. Gerardi, Secretary.

Sworn to and subscribed before me this 20th day of September 1949.

[SEAL] ELVA G. MASLIN
(My commission expires March 30, 1950.)

640 ACRES PATENTED COAL LAND
60 million tons bituminous coal, reports any public library, U. S. Geol. Su. Bull. 225—Page 240-246, or Deer Creek Coal Field. $15.00 per acre.
WEST END MINING CO.
1921½ Maple Ave., Los Angeles 11, Calif.

BUYERS OF SURPLUS COPPER, INSULATED WIRES AND CABLES
No lengths too long or too short
Telephone: EAstgate 7-4778
PIERCE CABLE CO.
2674 Clybourn Ave., Chicago 14, Ill.

WANTED
Ores and chemicals—any raw materials from owners.
Gertrude A. Meeker
(25 years Mining experience)
8468 Ridpath Drive, Hollywood 46, Calif.

2 CLAIMS
Mineral Survey 3596-3597. Kennecott Corp. Claims on All Sides at Ray.
WEST END MINING CO.
1921½ Maple Ave., Los Angeles 11, Cal.

It costs no more
to have your instruments of any make
repaired by the makers of the
WORLD'S FINEST SURVEYING INSTRUMENTS
(since 1871)
C. L. BERGER & SONS, INC.
37 Williams Street, Boston 19, Mass.

MINES
MILLS
INDUSTRIAL PLANTS
MACHINERY
-ALL KINDS-
BOUGHT-SOLD LIQUIDATED
DULIEN STEEL PRODUCTS, Inc.
of Washington
9765 E. Marginal Way - Seattle 8, Wash. - LAnder 6000

LOCOMOTIVES WANTED
If you have a Mancha locomotive for sale, mail description, serial number and price.
W9800 Engineering and Mining Journal
330 W. 42nd St., New York 18, N. Y.

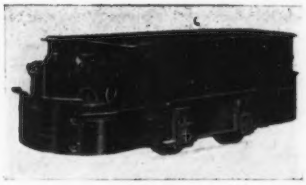
SLUDGES WANTED
If you have any metallurgical or chemical by-product sludges which may contain rare or minor metals, please contact:
Metallurgical Process Division
Saratoga Laboratories, Inc.
Saratoga Springs, New York
Sludges bought outright or recovery processes developed under contract.

FOR RENT
Complete new Bodinson Dry Bank placer washing plant. Capacity 150 yards hour, and 5000' 5" pipe. Also 30 yard hour pilot plant, truck and other mining equipment.
DARRELL V. COLE
P. O. Box 859 Wickenburg, Arizona

DEPENDABLE EQUIPMENT AT A SAVINGS IN TIME AND COST

COMPRESSORS

1—131 CFM Chicago Pneumatic, 8½" and 4¾"x5".
1—139 CFM Chicago-Pneumatic, 8⅜" and 4¾"x5".
1—142 CFM Ingersoll-Rand Motor Compressor, 6" and 5"x5" with built in 25 HP. West. motor.
1—194 CFM Gardner-Denver 7" and 5¾"x5".
1—284 CFM Ingersoll-Rand, 6 cyl., 6" and 5"x5".
2—393 CFM Ingersoll-Rand, 12" & 6½"x10".
1—315 CFM Ingersoll-Rand, 6 cyl., 7" and 6¼"x5".
1—382 CFM Chicago-Pneumatic, 4 cyl., 9⅜" and 5½"x5½".
1—447 CFM Ingersoll-Rand, 14" & 7½"x12".
1—528 CFM Ingersoll-Rand, 14"x12".
1—637 CFM Sullivan angle compound, 14" and 8¾"x10".
1—800 CFM Ingersoll-Rand 18" & 11"x16".
1—888 CFM Ingersoll-Rand, 19" & 12"x16".
1—105 CFM Schramm portable straight line, 3-13/16"x4½", driven by Buda gas engine, trailer mounted on 4 pneu. tires.
1—210 CFM Worthington portable "Blue Brute", 6" & 5⅜"x4½", driven by Continental gas engine, trailer mounted on 4 steel wheels.
2—310 CFM Gardner-Denver portable, 6"x 5½", driven by Buda Gas Engine.
1—153 CFM Ingersoll-Rand low pressure, 9"x6".
1—273 CFM Ingersoll-Rand low pressure, 12"x6".
1—698 CFM Union low pressure, 16"x12".
1—840 CFM Laidlaw duplex low pressure, 13"x10".



LOCOMOTIVES

2—2 to 2½-Ton Mancha Battery, 18" gauge.
1—2 to 2½-Ton Whitcomb Battery, 24" ga.
2—7-Ton General Electric Permissible Type Battery Locomotive, 36" gauge.
1—7-Ton Mancha Battery, 36" gauge.
2—8-Ton General Elec. Battery, 36" gauge.
4—10-Ton Atlas Battery Locomotives, 36" ga.
3—6½-Ton General Elec. Trolley, 36" gauge.
1—5"x16" Porter Compressed Air, 18" ga.
1—5½"x16" Baldwin Compressed Air, 30" ga.
1—3-Ton Whitcomb Gas Driven, 24" gauge.
2—18-Ton Davenport Steam Locomotives, 1—36" gauge, 1—standard gauge.
1—3-Ton Ruth Gasoline Driven, 18" gauge.

CLASSIFIERS

1—36"x20' Dorr Duplex Rake Classifier.
1—54"x16' Morse "Trueline" Rake Classifier.
1—8' bowl attachment from Dorr 27" simplex Classifier.
3—"St. Joe" type Hydraulic Classifiers, 10 cells, 20 spigots.
1—24"x8' Akins Classifier.

SLIP-RING MOTORS

1—10 HP G.E. 3/60/220, 900 RPM.
1—15 HP Westinghouse, 3/60/440, 1200 RPM.
1—15 HP Fairbanks-Morse, 3/60/440, 900 RPM.
2—20 HP G.E. 3/60/220, 1200 RPM.
1—20 HP G.E. 3/60/440, 720 RPM.
1—30 HP G.E. 3/60/440, 900 RPM.
1—30 HP G.E. 3/60/220-440, 1200 RPM.
1—50 HP Westinghouse, 3/60/440, 1200 RPM.
2—52 HP G.E. 3/60/220, 900 RPM.
2—52 HP G.E. 3/60/220-440, 600 RPM.
1—75 HP Westinghouse, 3/60/440, 720 RPM.
1—75 HP G.E. 3/60/440, 450 RPM.
1—82 HP G.E. 3/60/440, 450 RPM.
1—100 HP G.E. 3/60/440, 695 RPM.
2—165 HP G.E. 3/60/440, 450 RPM.
1—200 HP G.E. 3/60/220-440, 450 RPM.

JAW CRUSHERS

1—8"x8" Universal Semi-Steel Crusher.
1—8"x24" Rogers Cast Steel Crusher.
1—9"x15" Farrell Blake type.
1—9"x16" Cedar Rapids All-Steel Crusher.
1—9"x16" New Morse Crusher.
1—8"x36" Universal All-Steel Crusher.
1—9"x36" Cedar Rapids.
1—15"x20" Universal All-Steel Crusher.
1—10"x24" Allis-Chalmers Jaw Crusher.
1—24"x36" Traylor "Type A."

BALL AND ROD MILLS

1—36"x24" New Morse Bros. Batch Mill.
1—4'x4' New Ball Mill.
2—6'x36" Hardinge Conical Ball Mills.
1—6'x48" Hardinge Conical Ball Mill.
1—6'x8' Marcy Ball Mill.
1—8'x22" Hardinge Conical Pebble Mill.
1—3'x8' Denver Eng. Works Tube Mill.
1—3'x9' Ruth Rod Mill.
1—5'x36" Hardinge Conical Ball Mill.
1—64½ Marcy Ball Mill.

BETTER MACHINERY—IT'S FULLY RECONDITIONED

ESTABLISHED 1898

MB MORSE BROS. MACHINERY CO.

P.O. BOX 1708 DENVER, COLORADO, U.S.A. CABLE "MORSE

COMPLETE ORE-MILLING PLANTS · CONCENTRATION · FLOTATION · MACHINERY · CYANIDE · AMALGAMATION

General Office and Plant: 2900 BRIGHTON BLVD., DENVER, COLO.

AIR COMPRESSORS
9 Electric 5000, 3176, 2200, 1528 & 1302 ft.
6 Diesel 1578, 1000, 676 & 500 ft.
LOCOMOTIVES
7 Diesel 80, 65, 45, 30 & 20 Ton.
22 Gas. 35, 25, 16, 12, 8 & 6 Ton.
R. R. CARS.
150 Dump Cars, 2, 4, 12, 20 and 30 Yd.
100—50-Ton Flat Cars. 66—50-Ton Gondolas.
150—8,000 & 10,000 Gal. Cap. Tank Cars.
STEEL STORAGE TANKS
2—74,000 Bbl. Cap. Vert. 114'7" x 40'.
12—10,000, 15,000, 20,000 & 25,000 Gal. Horiz.
LARGE JAW CRUSHERS
7—60x84, 40x48, 36x42 & 24x36.
ROTARY DRYERS & KILNS
70" x 35' Indirect Ruggles Coles XB-10.
104" x 85' Ruggles Coles Class A-18.
4' x 20' Ruggles Coles XA-2.
Single Shell Direct 4 x 30, 5 x 35, 5 x 40, 5 x 50, 5½ x 40, 6 x 20, 6 x 28, 6 x 30 & 8 x 60.
Kilns 5 x 50, 7'6" x 125, 6 x 60.
BALL, ROD & TUBE MILLS
6' x 48" Hardinge Conical Ball Mill.
5" x 22" Hardinge Conical Ball Mill.
4x10, 6x6 & 7x5 Cylindrical Ball Mills.
7' x 18' Allis Chalmers 2 Compartment Mill.
6x14 Hardinge Classifier.
36" & 78" Spiral and 4' Dorr Rake Classifier.
3x8, 4x10 & 7x9 Rod Mills. Marcy, Hardinge.
5 x 22 Allis Chalmers Tube Mill.
4 x 16 & 5½ x 20 Tube Mills. Steel & Silex Lined.
PULVERIZERS
#1½ Sturtevant Ring Roll Mill.
6' x 48' Hardinge Mill with Air Classifier.
4 & 5 Roll Low Side Raymond Mills.
#0 & #1 Raymond Automatic Pulverizers.
STANNHOPE, 60 E. 42nd St., New York 17, N. Y.

DIESEL GENERATOR PLANTS

COMPLETE WITH SWITCHBOARDS
1000 KW to 100 KW
STATIONARY and PORTABLE
AT GREATLY REDUCED PRICES
NEW UNIT GUARANTEE

HERCULES ELECTRIC MACHINERY and EQUIPMENT CO.

Tel. NEvada 6-2808—Cable Address HEMCOY 1412 So. Alameda St., Compton, Calif.

FOR SALE

Allis-Chalmers Continuous Steel Lined Ball Mill, 8' dia. x 7' long, complete with balls, drive and 250 HP motor.
Williams #1 Hammer Mill.
Hydroseal Slurry Pump, 4"x4".

PERRY EQUIPMENT CORP.
1519 W. Thompson St., Phila. 21, Pa.

FOR SALE

25,000 ft. #4-2/c round 133-strand flexible Neoprene jacketed 600-Volt cable on 1000-ft. reels, 29c-ft., F.O.B. Chicago.

Universal Wire & Cable Co.
2662-2718 Clybourn Ave. Chicago 14, Ill.

FOR SALE

Anaconda Crushing Rolls
1—Pair Allis-Chalmers 40" x 15". Completely rebuilt and rebabbitted.

JOHNSON & HOEHLER, Inc.
P. O. Box 102 Lansdowne, Pa.

BOILERS
10 to 1000 H. P.
NEW-USED
RECONDITIONED
Steam, Gas and Electric
Power Equipment
J. PARKER THOMPSON CO., INC.
507 FIFTH AVE., NEW YORK CITY
MURRAY HILL 7-6547-8-9

CLASSIFIERS
1—60"x23' Denver Simplex Cross-flow Classifier.
1—6'x22' Dorr Type Duplex Classifier.

FLOTATION MACHINES
3—#24 Denver, "Sub-A", 8-cell, wood tank.

PUMPS—SAND
6—2" Wilfleys—Rubber Lined—Motorized.

MAGNETIC PULLEYS
1—24" Belt Feeder, 5'6" centers, with 26" face x 24" dia. Dings Magnetic Pulley, R.C. Drive to 2 HP Gear Motor, complete with motor generator set.
2—26" face x 24" dia. Dings 250 volts DC Magnetic Pulleys.

CONCENTRATING TABLES
4—6'x16' Deister Type. New Rubber Decks—Motorized.
1—6'x16' Butchart. New Rubber Decks—Motorized.

BELT CONVEYORS
1—14", 20' centers, new belt, V-belted to 1½ HP Motor.
1—24", 15' centers, Motorized.
1—30", 70' centers, Motorized.
1—42", 20' centers, Motorized.

FILTERS—DISC
1—4', 6-disc, Eimco, with Vacuum Equipment.

DIESEL GENERATORS
3—D13000 Caterpillar Diesel Engines, direct connected to 75 KW, 440 volt AC Generators.
1—D-4400 Caterpillar Diesel Power Unit, V-belted to 220 volt AC Generator.

SLUSHER HOIST
1—Ingersoll-Rand, 3-drum, with built-in AC Motor and 1½ yd. Crescent Scrapers.

MISCELLANEOUS EQUIPMENT
1—35 HP Allis-Chalmers, Slip-ring Motor, 3 ph., 60 cy., 440 volts, 850 RPM, with controller and grids. Several Hundred feet 6" wood pipe, wire wrapped.
2—Model "A" Adams Wet Reagent Feeders.
1—24" Denver Dry Reagent Feeder, Cone Type, Motorized.
1—Jeffrey-Traylor Dry Reagent Feeder, Vib. Type.
1—75 HP Gen. Elec. Motor, 3 ph., 60 cy., 400 volts, 600 RPM, with starter.
3—10'x9' Deveraux Agitators, wood tanks, Motorized.
1—#22 Vulcan Hoist with 40 HP Gen. Elec. Type Single Speed Motor (new condition.) Ingersoll-Rand Motor Mounted Pumps, 1 HP to 25 HP.
1—12'x10' Steel Hopper Bin.
Fused Safety Switches, 30 amp. to 200 amp.
Mine Skips—Ore Cars.
Line Oilers—Drill Steel.
Radiation—Stokers.
Wagon Drills.

WRITE FOR OUR NEW BULLETIN NO. 10

FLORENCE MACHINERY AND SUPPLY CO.

904 Equitable Bldg. **Denver 2, Colorado**

HOSE SALE

DELIVERED FREIGHT PREPAID

BRAND NEW "GOODRICH"

4" DISCHARGE HOSE

Complete with male and female couplings, 200-lbs. pressure, rubber-lined, in 50-ft. lengths. SALE PRICE:

USES
Strip Mining; Portable Pipe Lines; Fire Hose; Sewer & Trench Work; Manholes; Discharge on Pumps.

$30.00
50-FT. LENGTHS
FREIGHT PREPAID UNITED STATES

Immediate Delivery • ***Order Now***

BERNSTEIN BROTHERS
SINCE 1890 - PHONE 8404
PUEBLO, COLORADO

FOR SALE

Marcy ball mill, Humphrey's Spirals, pumps, motors and other surplus mill equipment. Also 800 and 100 KW Diesel generating plants. Inspect at Pacific Bridge Company, Park City, Utah, or contact Pacific Bridge Company, 333 Kearny, San Francisco.

LOCOMOTIVES FOR SALE OR LEASE

2—100 ton, diesel electric, tractive effort 59,700#, four traction motors, new 1940-42, excellent condition for ICC.
1—44 ton, GE 380 HP railway type diesel electric switcher, new 1945, Caterpillar D-17000 diesel units, four traction motors.
2—65 ton Porter saddle tank steam locomotives, new 1942, immediate delivery.

LOCOMOTIVE CRANES

1—Ohio Model F 30 ton diesel powered new 1946, double drums, Caterpillar diesel unit.
2—Ohio Model G 35 ton gas powered new 1943 but unused, Buda power units, double drums.

CARS

75—all steel 70 ton capacity hopper cars.
25—all steel 50 ton drop bottom gondolas.
19—all steel 20 cu. yd. air dump cars.

Our stock includes many other locomotives, cars, cranes and heavy equipment items.
We invite your inquiries.

Write — Phone — Wire

Pan-American Engineering Co.
P. O. Box 2576 Telephone L.D. 339
Dallas, Texas

EDWARDS ROASTING FURNACE

15 spindle, simplex, with tilting arrangement, belt drive, 62'-9½" long, overall outside dimensions; width of hearth 6'-6½" inside dimension.

Also have 3 ball mills for sale.

Primos Chemical Co.
Primos, Pa.

CONTRACT COMPLETED

Selling complete mining and stripping outfit. All equipment purchased factory new less than two years ago.

One—Bucyrus-Erie 170-B Electric Shovel.
Ten—Euclid TD End Dump Trucks.
Five—Caterpillar D-8 Tractors with Dozers.
Three—Caterpillar No. 12 Motor Patrols.

Midwest Location—One or All.
Attractive Price—No Dealers.

FS-1136, Engineering & Mining Journal
520 N. Michigan Ave., Chicago 11, Ill.

SPECIAL OFFERING

1—New 18 x 32 solid steel frame style D Crusher.
1—Factory refd.—6x10 plate from Crusher.
1—New 14 x 28 solid steel frame Jaw Crusher.
1—No. 6 McCully Crusher in good running condition, just taken from service.

ACME ROAD MACHINERY CO.
FRANKFORT NEW YORK

Placer Dredges, 4½', 7½', 8', elec., diesel.
Diesel-electric generators, 600-1250 HP.
Air compressor, 1,574', diesel, 300 HP.
Koehlds, bottom, side, rear dumps (11).
Gyratory jaw, hammermill crushers (9).
Locomotives, diesel, gas, 7 to 35 tons.
Porter, Vulcan 18-ton steam, 36" ga. locos.
Shovels, draglines, elec., diesel, ¾ to 10 yd.
B-E shovel front att., 2¼ yd., 52B-55B.

H. Y. SMITH CO. Milwaukee 2, Wis.

For Sale — Ball Mill and Classifier

1—Patterson unlined chrome manganese tube mill, 3' dia. inside by 10' long inside. New-type Patterson construction consisting of enlarged bulbous sections spaced at intervals around mill and extending longitudinally for full length of mill. Equipped with machine-cut gears mounted on mill head and driven at 22 R.P.M. by silent chain drive with service factor of 1½. Charged with 6,230 pounds of chromium nickel vanadium steel alloy balls.
1—Patterson air separating and classifying system complete with connections for feed end to mill, dampers, vent and two vent bag arresters for ultra fines and booster fan. Complete electrical equipment for both units. Inquire

W. T. Hulse, Interchemical Corporation
Bound Brook, N. J.

MACHINERY

Flotation Plant: Modern 150 ton with Allis-Ch. 6x6 mill, etc., and bolted steel building. All A-1.

Transformers: 3 GE 150 kva 2200-440.

Loaders: Eimco 12-B — 18 or 24" ga.

Vibrating Screens: 4x10 double and triple deck Stephens-Adamson—Like new.

Filter: 2-Leaf American 6 ft. w/vac. eq.

Weightometer: Merrick Model E; 24" belt.

PAUL F. SMITH
39 W. Adams St. **Phoenix, Arizona**

LIMESTONE DEPOSIT FOR SALE

High grade, crystalline, white to gray and striped, exceptionally clean deposit, max. thickness 280'. Analysis: 54.60% Lime, 1.07 Magnesia; Suitable Terrazzo chips, Concrete aggregate, Building stone, chemical uses. S. W. slope San Bernardino Mtns. El. 4,772 ft. Includes Millsite. Both adjoin Prim. State Highway. Will consider good lease.

P. O. Box 912 Lake Arrowhead, Cal. Ph. Arrd 5585

---

300 ft. 6" pipe; 3000 ft. 2" pipe; 30 ton 35# rail; 30 ton 25# rail at $50.00 per ton. 24' x 42' steel framed Bldg. with 4 ton traveling crane; 1500 CFM compressor; Air Receivers; Transformers 300 KVA down; Bucket elevator housing 24" x 48" 70' centers with drive; Timber Framing Saws; All priced to sell.

Box 609 **Yerlington, Nevada**

ELECTRICAL CABLE

- for every industrial and power application.
- Special constructions. Odd lengths.
- Large stocks on hand of high voltage, lead covered cables not ordinarily stocked by your regular supplies.
- Cut to length. Reasonably priced.

UNIVERSAL Wire and Cable Co.
2874 N. Clybourn Ave. Chicago 14, Ill.

RELAYING RAIL

All Sizes
Track Accessories

LEFTON INDUSTRIAL CORP.
***Genl. Office:* 212 Victor St.**
St. Louis 4, Mo.

MOTORS, GENERATORS, TRANSFORMERS
1 — 1500 H.P.
Bought and Sold
New and Rebuilt
ELECTRIC EQUIPMENT CO.
ROCHESTER 1, N. Y.

TRUCKS: 8—Euclid model FD, 15 ton capacity, 12 yd. rock bodies, Cummins diesel motors.

DRAG SCRAPER OUTFIT: Sauerman 1½ yd. Crescent bucket, 60 H.P., 440 volt, motor and controls, cables and blocks, etc.

OVERHEAD TRAVELING CRANES: 2—62' span, 10 tons capacity, three motors, 5, 10 and 12 H.P., 3 phase, 60 cycle, 440 volt. These Cranes are NEW. With or without runway and uprights.

CARS: 20 yd. and 30 yd., all steel, air dump, lift and drop door type.

CONVEYOR BELT: Large quantity of Goodrich, SUPER LONG LIFE CORD CONVEYOR BELT, 42" wide, 6 ply, 42 oz. duck, 7/32" top cover, 1/16" bottom cover, on original reels, all NEW NATURAL RUBBER, with or without mechanical parts.

JAW CRUSHERS: 10 x 20" to 48 x 60".

REDUCTION CRUSHERS: All sizes, Nordberg, Telsmith, Traylor, Allis Chalmers, etc.

JAW CRUSHER—SPECIAL: Farrel 24 x 36", with or without motor and drive.

DRYERS: Single shell 10' dia. x 90'6" long, complete with all equipment, offered with or without coal firing furnace, dust collector, etc. Located in Minnesota.
1—Ruggles Coles, double shell, class XF12, 80" x 60'.
1—Traylor single shell 60" x 40', with or without motor.

CLASSIFIERS: 2—NEW 78" x 25' Spiral Classifiers, manganese fitted, with tank and 10 H.P. motor, etc., located in Missouri. 1—Aikens 24" x 10'9" with 2 H.P. motor.

PULVERIZERS: 1 Hardinge Conical Mill 8' x 30", located in Michigan.
1—4' x 10' Rod or Ball Mill, all steel lined, heavy duty type.

SCREEN: Nordberg 4' x 12', double deck, 7½ H.P. motor.

TUGGER HOIST: Ingersoll Rand 35 H.P., 220/440 volt.

MINE HOIST: 1—All steel single drum, 8 ft. dia., 1¼" rope, 64,000 lbs. single line pull, 600 FPM, 400 H.P., 2200 volts, A.C., with all control equipment. Located in California.
1—350 H.P., single drum, 88" dia., 60" face.
1—250 H.P., single drum 7'3" x 5', 30,000 lbs. single line pull, 750 FPM, complete.
1—200 H.P., single drum, 42" face, 60" dia., A.C., 2200 volts, and controls.
1—150 H.P., double drum, 38" dia., 42" face, 440 volts, A.C. complete with controls.
1—100 H.P., double drum, 48" dia., 36" face, Lilly controllers.

LOCOMOTIVE: 80 ton, 6 wheel, saddle tank, rebuilt, for Sale or Rent.

SHOVELS and DRAGLINES: Diesel and Electric, 1 yd. to 1¾ yd. capacity.

SHOVELS—SPECIAL: 1—3 yd. Electric, 2200 volt, A.C. Ward Leonard control equipment. 1—Lima 1061 diesel, 3 yd. capacity.

A. J. O'NEILL
Lansdowne Theatre Building
LANSDOWNE, PA.
Phila. Phones: Madison 3-8300 - 3-8301

---

for **IMMEDIATE DELIVERY**
of **RUBBER PRODUCTS**

CONVEYOR BELTING, TRANSMISSION BELTING, ELEVATOR BELTING, FIRE, WATER, AIR, STEAM, SUCTION and WELDING HOSE

CALL *WIRE* *WRITE* **CARLYLE**
THE RUBBER HEADQUARTERS

CARLYLE RUBBER PRODUCTS ARE NEW, GUARANTEED & LOW PRICED

NEW GUARANTEED

CONVEYOR BELTING

ABRASIVE RESISTANT COVERS

Width	Ply	Top-Bottom Covers
48"	8	1/8" — 1/16"
42"	5	1/8" — 1/16"
36"	6	1/8" — 1/16"
30"	6	1/8" — 1/16"
30"	5	1/8" — 1/16"
26"	5	1/8" — 1/32"
24"	5	1/8" — 1/32"
24"	4	1/8" — 1/32"
20"	5	1/8" — 1/32"
20"	4	1/8" — 1/32"
18"	4	1/8" — 1/32"
16"	4	1/8" — 1/32"
14"	4	1/16" — 1/32"
12"	4	1/16" — 1/32"

Inquire For Prices — Mention Size and Lengths

TRANSMISSION BELTING

HEAVY-DUTY FRICTION SURFACE

Width	Ply	Width	Ply	Width	Ply
18"	6	10"	6	6"	5
16"	6	10"	5	5"	5
14"	6	8"	6	4"	5
12"	6	8"	5	4"	4
12"	5	6"	6	3"	4

Inquire For Prices — Mention Size and Lengths.

ENDLESS "V" BELTS

"A" Width All Sizes —
"B" Width All Sizes —
"C" Width All Sizes —
"D" Width All Sizes —
"E" Width All Sizes —

Sold in Matched Sets.
Inquire For Prices — Mention Size and Lengths.

SPECIAL OFFER . . . HEAVY DUTY RUBBER HOSE

FIRE HOSE

APPROVED SPECIFICATION HOSE EACH LENGTH WITH COUPLINGS ATTACHED

I.D. Size	Length	Per Length
2½"	50 feet	$28.00
	25 "	16.00
2"	50 "	23.00
	25 "	13.00
1½"	50 "	20.00
	25 "	11.00

Specify Thread On Couplings

AIR HOSE

I.D. Size	Length	per Length	Universal Couplings
½"	25 feet	$5.00	$1.50 Pair
	50 "	10.00	1.50 Pair
¾"	25 "	7.50	1.50 Pair
	50 "	15.00	1.50 Pair
1"	25 "	10.00	1.50 Pair
	50 "	20.00	1.50 Pair

LARGER SIZES ALSO AVAILABLE
All Prices—Net — F.O.B. New York

WATER HOSE

I.D. Size	Length	per Length	I.D. Size	Length	per Length
¾"	25 feet	$4.25		35 feet	$10.50
	50 "	8.00		40 "	12.00
1"	25 "	6.25		50 "	15.00
	50 "	12.50	1½"	25 "	10.00
1¼"	25 "	7.50		35 "	14.00
				50 "	20.00

Each Length with Couplings Attached

CARLYLE RUBBER CO., Inc.

62-66 PARK PLACE, NEW YORK 7, N. Y. Phone: BArclay 7-9793

Rotary Kilns—6½' x 70' & smaller. One 9' x 170'.
Rotary Dryers—3' x 30'—4' x 30'—6' x 40'—5½' x 50'—6½' x 60'—8' x 70'—7' x 60'.
Tube & Ball Mills—6' x 9'—5' x 22'—5½' x 10-7".
Fuller-Lehigh Mills—22"—47" & 32"—Bradley Mills.
Jaw Crushers—From 10" x 6" up to 38" x 24".
Crushing Rolls—From 16" x 10" up to 72" x 20".
1—7" Newhouse Crusher, latest type.
Sturtevant Rotary fine crushers—No. 0—No. 1—No. 1½ and No. 2.
Ring Roll Mills—Sturtevant No. 1—No. 2.
15'—16' & 18' Hereschoff furnaces.
Gyratory Crushers, No. 3 and No. 12.
8'—14' air separators.
Magnetic separators—jigs—screens—classifiers and thickeners.
5', 6' & 7' dia. Rod Mills.
Mine Hoists.
One 4 roll Raymond Mill, low side.
8' x 10'—8' x 12'—11½' x 19' Rotary Filters.

W. P. HEINEKEN
227 Fulton St., N. Y.

FOR SALE

1 Maloney Transformer — Excellent condition, Dated 3-28-41, 4000 KVA, Self Cooled; 6000 KVA, fan cooled, 13200/26400 to 2400 Volts, 3 phase, 60 cycle. Now operating, but will be available about January, 1950.

For details contact

GOUVERNEUR TALC CO.
GOUVERNEUR, N. Y.

ALPHABETICAL INDEX TO ADVERTISERS

Where an asterisk * precedes manufacturer's name, more detailed information may be found in the *1948-1949 edition of the Mining Catalogs*

*Air Reduction Sales Co. ... 179
Albert Pipe & Supply Co. ... 201
*Allen-Sherman-Hoff Co. ... Second Cover
*Allis-Chalmers Co. ... 11, 16, 26, 34, 62
*Aluminum Co. of America ... 29
*American Air Filter Co., Inc. ... 147
American Brass Co. ... 166
*American Cable Div., American Chain & Cable ... Third Cover
American Manganese Steel Div. (American Brake Shoe Co.) ... 42, 146
*American Mine Door Co. ... 188
Atlas Powder Co. ... 52
Atlas Steels, Ltd. ... 148
Armstrong-Bray & Co. ... 191
*Atlas Car & Mfg. Co. ... 130

Baker Mfg. Co. ... 50
*Barber-Greene & Co. ... 138
*Bethlehem Steel Co. ... 25
*Birdsboro Steel Fdry. & Machine Co. ... 174
Black, Sivalls & Bryson, Inc. ... 41
Booth Engineers ... 124
Boston Woven Hose & Rubber Co ... 169
*Boyles Bros. Drilling Co., Ltd. ... 119
*Bucyrus-Erie Co. ... 22
Builders Providence ... 189

*Card Iron Works Co., C. S. ... 150
*Carnegie-Illinois Steel Corp. ... 137
Cate Equipment Co. ... 152
Caterpillar Tractor Co. ... 10
*Chemical Construction Corp. ... 55
*Chicago Pneumatic Tool Co. ... 34b, 190
Christensen Diamond Production Co. ... 160
Climax Molybdenum Co. ... 142
*Colorado Fuel & Iron Corp. ... 153
*Connellsville Mfg. & Mine Supply Co. ... 130
Conrader Co., R. ... 151
*Coppus Engineering Corp. ... 53
*Crane Co. ... 156
*Cummins Engine Co., Inc. ... 175

*Denver Equipment Co. ... 51
*Detroit Diesel Engine Div., General Motors ... 30
*Differential Steel Car Co. ... 144
*Dings Magnetic Separator Co. ... 182
*Dixie Mchy. Mfg. Co. ... 136
*Dorr Company ... 20
*Dow Chemical Co. (Great Western Div.) ... 58
*duPont de Nemours & Co., E. I., Inc. (Explosives Dept.) ... 14
*duPont de Nemours & Co., E. I., Inc. (Rayon Div.) ... 159

*Edison Storage Battery Div., Thomas A. Edison, Inc. ... 133
*Eimco Corporation ... 17
Electric Machinery Co. ... 178
*Electric Storage Battery Co. ... 115
*Ensign Bickford Co. ... 185

Flexible Steel Lacing Co. ... 191

Galigher Co. ... 24
*Gardner-Denver Co. ... 44, 45
Gates Rubber Co. ... 28
*General American Transportation Co. (Process Equip. Div.) ... 181
*General Electric Co. (Apparatus Dept.) ... 12, 13
*General Electric Co. (Construction Materials Dept.) ... 61
Gico ... 155
*Goodall Rubber Co., Inc. ... 141
*Goodman Mfg. Co. ... 27
Goodrich Co., B. F. ... 4
Goodyear Tire & Rubber Co. ... 21
*Gould Storage Battery Corp. ... 59
Greensburg Machine Co. ... 149
Grinnell Co., Inc. ... 43

Hamilton Rubber Mfg. Co. ... 46
*Hardinge Co., Inc. ... 202
Hendrick Mfg. Co. ... 191
Hercules Powder Co. ... 65
Hillman Co., C. Kirk ... 195
Holman Bros., Ltd. ... 176
Humphreys Investment Co. ... 150

*Independent Pneumatic Tool Co. ... 167
Industrial Brownhoist Corp. ... 32
*Ingersoll-Rand Co. ... 3
International Harvester Co. ... 163
International Nickel Co. ... 177

*Jeffrey Manufacturing Co. ... 125
Jones & Laughlin Steel Corp. ... 31, 57
Joy Manufacturing Co. ... 18, 19

*Kennedy-Van Saun Mfg. & Engrg. Corp. ... 38, 39
*Koehring Co. ... 8, 9
Knox Manufacturing Co. ... 154
*Kwik-Mix Co. ... 8, 9

*Laughlin Co., Thomas ... 138
Layne-Bowler, Inc. ... 193
Ledeen Mfg. Co. ... 154
*Leschen & Sons Rope Co., A. ... 173
Lima Shovel & Crane Div. ... 168
*Link-Belt Co. ... 164

Macwhyte Co. ... 161
Marion Power Shovel Co. ... 183
McGraw-Hill Catalog Service ... 150
*Merrick Scale Mfg. Co. ... 193
Mine & Smelter Supply Co. ... 158
Mt. Vernon-Woodberry Mills ... 184
*Morris Machine Works ... 140
*Mosebach Electric & Supply Co. ... 155
*Morse Bros. Machinery Co. ... 188
*Mott Core Drilling Co. ... 191

Nagle Pumps, Inc. ... 151
*National Filter Media Corp. ... 134
*National Malleable and Steel Castings Co. ... 180
*Naylor Pipe Co. ... 143
New York Engineering Co. ... 195
Nicholson & Co., W. H. ... 152
*Nordberg Mfg. Co. ... 35
Northwest Engineering Co. ... 15

Ohio Brass Co. ... 47
Omaha Scientific Supply Co. ... 189

Parsons Co. ... 8, 9
Pennsylvania Drilling Co. ... 195
*Pennsylvania Crusher Co. Div., Bath Iron Works ... 171
*Pioneer Engineering Works ... 187

Raybestos-Manhattan, Inc., Manhattan-Rubber Div. ... 56
Republic Rubber Div., Lee Rubber & Tire Corp. ... 172
Research Corp. ... 201
Robins-Conveyors Div., Hewitt-Robins, Inc. ... 128, 129
Roebling's Sons Co., J. A. ... 49
Ryerson & Sons, Inc., J. T. ... 117

*Sanford-Day Iron Works ... 162
*Sauerman Bros. ... 149
*Schramm, Inc. ... 132
Searchlight Section ... 195, 199
Sintering Machinery Corp. ... 144
Smith Engineering Co. ... 63
*Smit & Co., Anton ... 195
*Smit & Sons, Inc., J. K. ... 126
Standard Oil Co. of Calif. ... 121
Stearns Magnetic Mfg. Co. ... 139
Stephens-Adamson Mfg. Co. ... 40
Stearns-Roger Mfg. Co. ... 145
Stoody Co. ... 165
*Straub Mfg. Co. ... 54
*Sturtevant Mill Co. ... 60
Syntron Co. ... 142

Texas Company ... 6, 7
*Thermoid Co. ... 23
Thew Shovel Co. ... 170
*Thomas Flexible Coupling Co. ... 146
Throwaway Bit Corporation ... 36, 37
*Timken Roller Bearing Co. ... Fourth Cover
*Traylor Engineering & Mfg. Co. ... 33

Union Oil Co. ... 186
U. S. Steel Subsidiaries ... 137

Victaulic Co. of America ... 131

Walworth Co. ... 48
Webb Corporation ... 201
*Wedge-Wire Corp. ... 152
*Western Machinery Co. ... 64
*Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp. ... Insert between pp. 34, 35
Wheel Truing Tool Co. ... 157
*Wilfley & Sons Co., A. R. ... 66

Yuba Manufacturing Co. ... 135

PROFESSIONAL SERVICES ... 192

SEARCHLIGHT SECTION
(*Classified Advertising*)

EMPLOYMENT
Positions Vacant ... 195
Selling Opportunities Offered ... 195
Positions Wanted ... 195

SPECIAL SERVICES
Contract Work ... 196

BUSINESS OPPORTUNITIES
Offered ... 195, 196

NOTICES
Legal ... 196

PROPERTY
For Sale ... 195, 196
For Rent ... 196

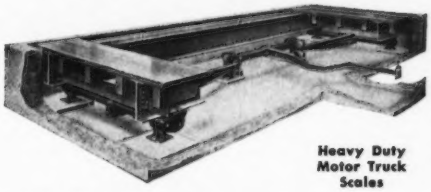
EQUIPMENT
(Used or Surplus New)
For Rent ... 196
For Sale ... 197-199

WANTED
Equipment ... 196
Miscellaneous ... 196

ADVERTISERS INDEX
Acme Road Machinery ... 198
Badgett, Russell ... 196
Berger & Sons, C. L. ... 196
Bernstein Bros. Pipe & Mchy. Co. ... 198
Briggs, Harry E. ... 195
Carlyle Rubber Co., Inc. ... 199
Cole, Darrell V. ... 196
Dulien Steel Products, Inc. ... 196
Electric Equipment Co. ... 198
Florence Machinery & Supply Co. ... 198
Governeur Talc Co., Inc. ... 199
Heineken, W. P. ... 199
Hercules Electric Machy. & Equip. ... 197
Interchemical Corp., Bound Brook Div. ... 198
Johnson & Hoehler, Inc. ... 197
Lefton Industrial Corp. ... 198
Meeker, Gertrude A. ... 196
Morse Bros. Machy. Co. ... 197
O'Neill, A. J. ... 199
Pacific Bridge Co. ... 198
Pan-American Engineering Co. ... 198
Perry Equipment Corp. ... 197
Pierce Cable Co. ... 196
Primos Chemical Co. ... 198
Saratoga Lab., Inc. ... 196
Smith Co., H. Y. ... 198
Stanhope, Inc., R. C. ... 197
Thompson Co., J. Parker ... 197
Universal Wire & Cable Co. ... 197, 198
West-End Mining Co. ... 195, 196

WEBB

INDUSTRIAL and MINING EQUIPMENT



Heavy Duty Motor Truck Scales

Heavy Weighing Equipment For:

- Mines and Industry
- Mine Car Scales
- Mine Tipple Scales

Since 1881

THE WEBB CORP.

WEBB CITY, MO., U. S. A.

Also Manufacturers of:

Blake Type Rock Crushers—Heavy Duty Crushing Rolls — Pillow Blocks — Elevator Buckets — Ore Washers — Pulleys for Elevator and Conveyor

Send for Catalogs.

FOR WATER, COMPRESSED AIR, etc.

Your exact requirements—packaged complete and ready to go for

FAST, SIMPLE, IMMEDIATE INSTALLATION

by one unskilled man with a wrench!

You can **RENT** or **PURCHASE**

SPEED-LAY

a complete factory-packaged PIPE SYSTEM

Pipe (Already Prepared) + Couplings and Fittings (Speed-Lay Type) + Valves and Accessories (As Required)

2½" to 12¼" o.d. black or galvanized—Larger sizes can be furnished

LIGHTWEIGHT FOR SAVINGS in Labor and Transportation

Write or phone for full information

IMMEDIATE DELIVERY

ALBERT

PIPE SUPPLY CO., INC.

Berry at North 13th Sts., Brooklyn 11, N. Y.

Phone EVergreen 7-8100

All These Were Once DUST COLLECTION PROBLEMS, TOO

48 Carbon Black Plants

203 Metallurgical Installations

205 Acid Plants

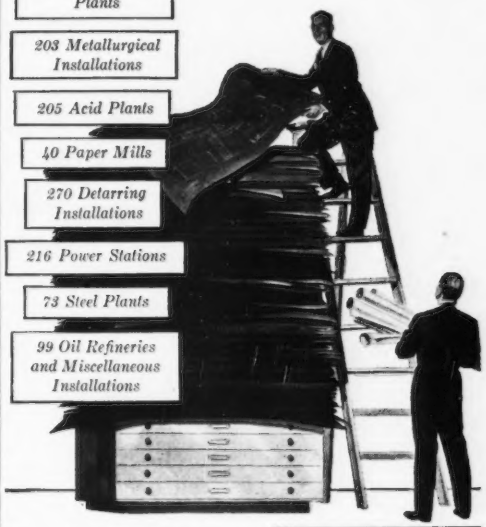
40 Paper Mills

270 Detarring Installations

216 Power Stations

73 Steel Plants

99 Oil Refineries and Miscellaneous Installations



Your electrical precipitator installation will be individually engineered...and based on the Research Corporation's *experience* graphically shown by that towering pile of thousands of blueprints.

This knowledge is a valuable asset that will help Research engineers to "tailor-make" your Cottrell installation. For example, they can more quickly determine the answers to such variables as the size, shape and type of discharge and collecting electrodes, their relative spacing, flue arrangements and many other factors. At Research you can count on *profitable solutions to individual problems.*

Typical One Day Collections

55 TONS OF SMELTER DUST CONTAINING 20% COPPER

3 TONS OF ANTIMONY DUST AT A SILVER REFINERY

208 TONS OF 12% COPPER DUST

250 TONS OF FLY ASH

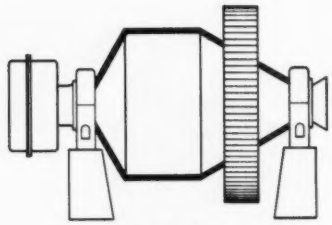
This experience enables one Research Corporation Cottrell to collect 6500 pounds of smelter dust, containing 14% cadmium and 30% lead, in one day. Other installations recover gold, silver, zinc, tin and other precious metals. Write for booklet giving valuable data. RC-11B

RESEARCH CORPORATION

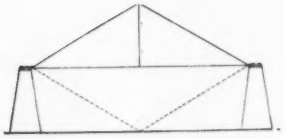
405 Lexington Avenue, New York 17, N. Y.

122 South Michigan Avenue, Chicago 3, Illinois

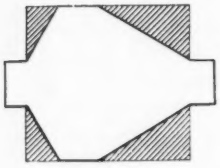
"Cones in Mills? . . . best thing ever happened!"



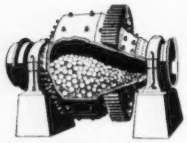
Less dead weight . . .



Truss-like structure . . .



No dead corners . . .



Ball segregation.

The Conical Mill was pioneered by Hardinge 43 years ago. There are that many years of grinding "know how" behind it.

The principle of the Conical Mill is sound. Note that the longitudinal cross section forms a truss. Strength is obtained without massive construction. Excessive dead weight, extra power and high operation costs are eliminated.

1. The discharge cone removes the fines from the mill as produced, eliminating wasteful overgrinding.
2. Automatic segregation of grinding media, by size, controls character of the product.
3. Power consumption and ball and lining wear are low due to reduction in peripheral speeds as particles are reduced in size.
4. Simplicity of structure makes for ease of operation and maintenance.
5. Less bearing friction loss due to reduction of dead weight.
6. Ultra-rapid discharge can be obtained by addition of a grate if desired.
7. Liners are designed to increase grinding rate, reduce wear and are easily replaced.
8. Recent redesign of component parts has further reduced power requirements and has practically eliminated maintenance expense.

For further information on recent developments, write for Bulletin AH-389-1 on wet grinding or Bulletin 17-B-1 on dry grinding.

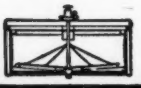
HARDINGE

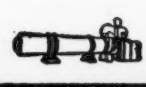
COMPANY INCORPORATED

YORK, PENNSYLVANIA — 240 Arch St. • Main Office and Works
NEW YORK 17—122 E. 42nd St. • 205 W. Wacker Drive—CHICAGO 6
SAN FRANCISCO 11—24 California St. • 200 Bay St.—TORONTO 1

CONICAL MILLS

COUNTER CURRENT CLASSIFIERS


THICKENERS CLARIFIERS

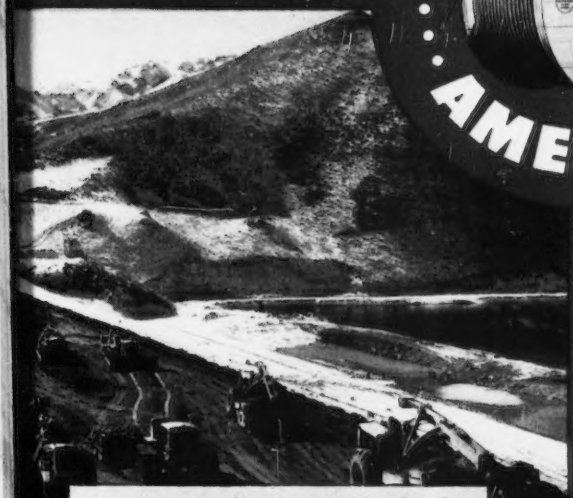

RUGGLES COLES DRYERS

CONSTANT WEIGHT FEEDERS

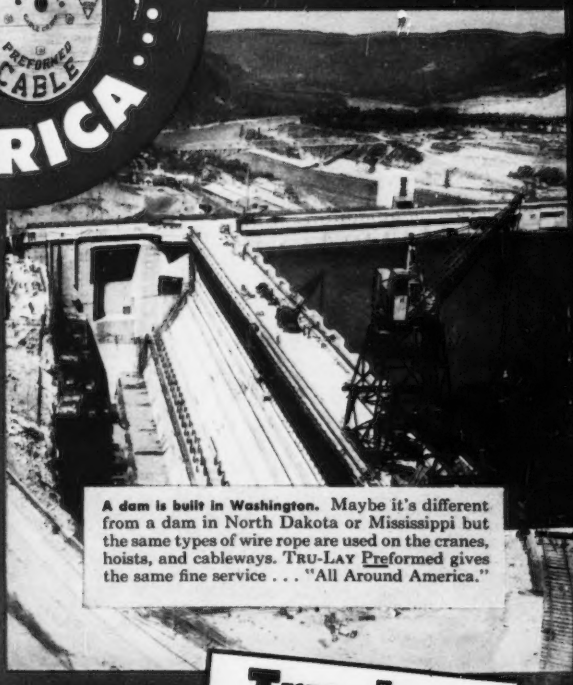
TUBE ROD AND BATCH MILLS

In Southern Illinois strip mining is big business. The shovels and draglines that remove overburden are big, too. TRU-LAY Preformed in large sizes has excellent qualities that make it a favorite for strip mining.

At Detroit a portal crane straddles gondola cars and loads them with foundry sand from storage piles. TRU-LAY Preformed is made in a construction designed for longer service under such abrasive conditions.



Out in Idaho, too, there are mountains of earth to be moved. Rooters, bulldozers, carrier scrapers, draglines and wagons are used. TRU-LAY Preformed Flattened Strand lasts longer under this gruelling service. It costs less to use.



A dam is built in Washington. Maybe it's different from a dam in North Dakota or Mississippi but the same types of wire rope are used on the cranes, hoists, and cableways. TRU-LAY Preformed gives the same fine service . . . "All Around America."

ACCO

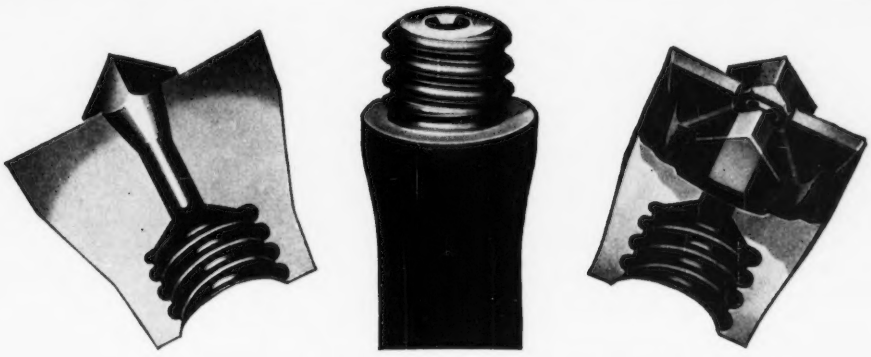
Wilkes Barre, Pa., Atlanta, Chicago, Denver, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, Portland, San Francisco, Seattle, Tacoma, Bridgeport, Conn.

AMERICAN CABLE DIVISION
AMERICAN CHAIN & CABLE

In Business for Your Safety

Tru-Lay *Preformed* **Wire Rope**

TWO MORE IMPORTANT TUNNEL PROJECTS DRIVEN WITH TIMKEN® ROCK BITS



America's smoothest drill team. Left: Multi-use Threaded Timken Rock Bit. Right: Carbide Insert Threaded Timken Rock Bit. Center: Shouldered and Threaded Timken Steel. Both bits interchangeable on the same threaded steel.

In December, 1947, Perini, Maney, Walsh & Rugo construction companies, Boston, Mass., were awarded a $9,530,000 contract for the construction of approximately 5 miles of 12-foot finished water tunnel by the Boston Metropolitan District Commission. When completed, this tunnel will have capacity to carry 200,000,000 gallons of water daily into the Boston Metropolitan Area.

Timken carbide insert rock bits were used in excavating 200,000 cubic yards of tunnel rock and the contractors expressed complete satisfaction with their performance and economy.

In August 1948, the same contractors were awarded a contract for the construction of the Squirrel Hill vehicular tunnel, Pittsburgh, Pa. This job involved the driving of twin 36′ x 26½′ horse-shoe tunnels 4,200′ long. Timken standard steel bits were selected in this case to provide the lowest cost per foot of hole in excavating 250,000 cubic yards of rock.

The same drill rods — threaded and shouldered — were used for both the carbide insert and standard steel bits. This gave the contractors great flexibility in using the most suitable type of Timken bit for any rock condition encountered.

We have the bits, know-how and experience; you have the rock. Get them together for utmost saving of time and cost. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address "TIMROSCO".

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

ROCK BITS